RESMED

VPAP® II ST-A

CLINICIAN'S MANUAL

Reorder number: 218039/2 02 04

MANUFACTURED BY:

ResMed Ltd 97 Waterloo Road North Ryde NSW 2113 Australia

Tel: +61 (2) 9886 5000 or 1 800 658 189 (toll free) Fax: +61 (2) 9878 0120 Email: reception@resmed.com.au

DISTRIBUTED BY:

ResMed Corp 14040 Danielson Street Poway CA 92064-6857 USA

Tel: +1 (858) 746-2400 or 1-800-424-0737 (toll free) Fax: +1 (858) 746-2900 Email: usreception@resmed.com

US DESIGNATED AGENT: ResMed Corp

EU AUTHORISED REPRESENTATIVE: ResMed (UK) Ltd

INTERNET

www.resmed.com

Contents

INTRODUCTION

The VPAP® II ST-A provides a mode of non-invasive positive pressure ventilation (NPPV) called Pressure Support with PEEP, which delivers two treatment pressures. This mode is sometimes called bi-level ventilation. A higher pressure is applied when the patient inhales and is called IPAP (inspiratory positive airway pressure). A lower pressure is applied when the patient exhales and is called EPAP (expiratory positive airway pressure), sometimes referred to as PEEP (positive end-expiratory pressure). The difference between the two treatment pressures represents the amount of pressure support provided to the patient.

The key to successful NPPV is synchronization—how effectively the ventilator keeps in step with, responds to and supports the patient's own breathing rhythm. The ventilator needs to sense when the patient is inhaling and exhaling and supply IPAP and EPAP accordingly. This manual includes information on how the VPAP II ST-A operates, as well as information on how to set-up the VPAP II ST-A to optimize ventilation.

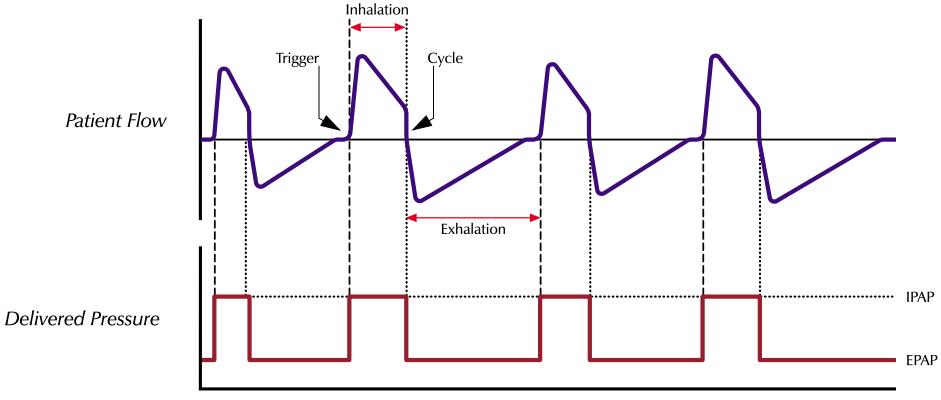


Figure 1: Device in synchrony with patient

MEDICAL INFORMATION

WARNING 

This icon draws your attention to possible personal injury.

CAUTION 

This icon draws your attention to possible damage to equipment.

NOTE 

This icon draws your attention to an informative note.

Please read this manual carefully before use.

CAUTION 

In the USA, Federal law restricts this device to sale by, or on the order of, a physician.

INDICATIONS

The VPAP II ST-A is intended to assist the ventilation of spontaneously breathing adult patients (66 lb or 30 kg) with respiratory insufficiency and/or obstructive sleep apnea. The patient is expected to have no more than minor and transient adverse effects in the case of ventilation not being provided for extended periods (eg overnight). The system is intended for use in the hospital or home, with patients who have adequate mental and physical capabilities to remove their mask quickly in case of system failure.

CONTRAINDICATIONS

The VPAP II ST-A should **not** be used in cases of severe respiratory failure where intubation is judged to be immediately necessary. In addition, VPAP therapy should be used with caution in the following cases:

- Emphysematous bullae, pneumothorax, pneumomediastinum, or past history of the above (indicating risk of pneumothorax or further barotrauma)
- Decompensated cardiac failure or hypotension, particularly if associated with intravascular volume depletion
- Massive epistaxis, or risk of recurrence if previous occurrence

- Pneumoencephalus, recent trauma or surgery that may have caused cranio-nasopharyngeal fistula (risk of entry of air into cranial cavity)
- Acute sinusitis, otitis media or perforated ear drum.

The clinician should assess on a case by case basis the relative risks and benefits of VPAP therapy in such a subject. When assessing the relative risks and benefits, the clinician should understand that the VPAP II ST-A flow generator can be set to deliver pressures up to 25 cm H_2O. Also in the unlikely event of certain fault conditions, a maximum static pressure of 35 cm H_2O is possible. If it is believed that such a pressure could present a risk to a particular patient, then this device must not be used.

For patients with limited respiratory capacity during sleep (for example emphysema, reduced central drive, neuromuscular, chest wall or lung parenchymal disease, and similar conditions), the use of the SmartStart feature may not be advisable; if the unit is stopped inadvertently by this feature (due to a leak, for example) the patient may have insufficient breathing to restart the unit. Therefore, a flow generator set in the Spontaneous mode should be used with caution in such subjects, until it is established that the subject triggers the device satisfactorily during sleep. This problem may be reduced by using the Spontaneous/Timed mode.

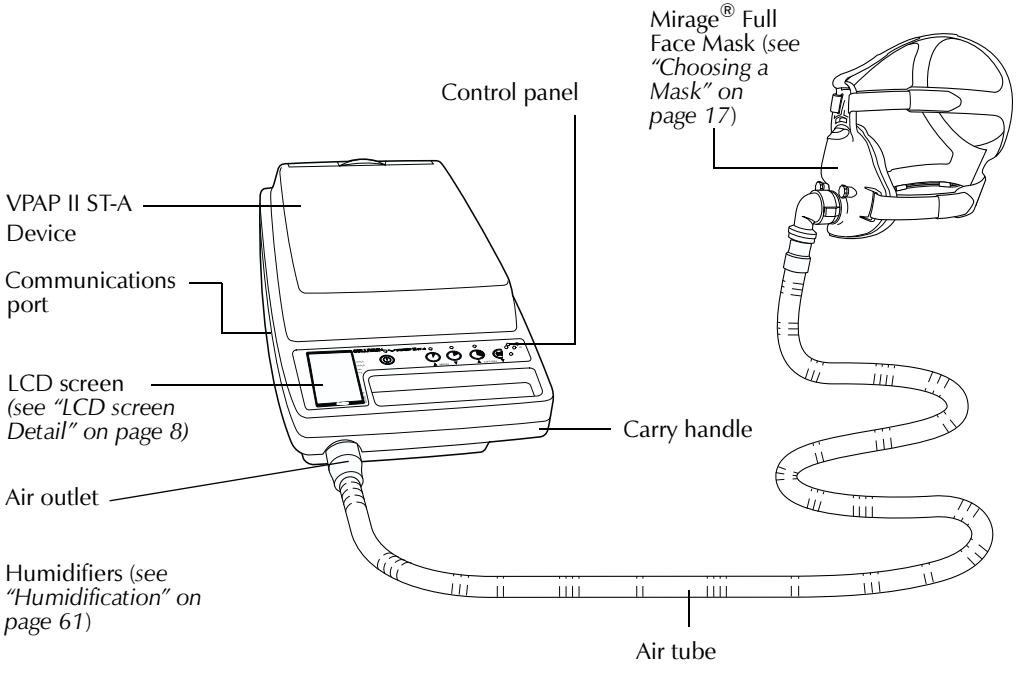
WARNINGS

- **This is NOT a life support ventilator.** VPAP II ST-A is a non-continuous ventilator intended to augment patient breathing. It is not intended to provide total ventilatory support or guaranteed volume delivery. It may stop operating with power failure or if a fault occurs in the product.
- **Explosion hazard**—do not use in the vicinity of flammable anesthetics.
- ResMed VPAP II devices have been designed and manufactured to provide optimum performance using ResMed vented mask systems. Other mask systems may be used, however some of the device's features may be affected. A qualified clinician should confirm the function of any feature(s) intended for use during therapy. Features affected may include:
  - Breath trigger and cycling performance may become more or less sensitive, or not function at all. Thus the patient may not be adequately ventilated in some cases. Therefore, other masks should only be used if the physician has confirmed correct operation for the particular patient.
  - Other mask systems may or may not have adequate venting
  - Accuracy of Leak and Tidal Volume measurement may be affected
  - SmartStart and Mask Alarm may not function reliably
  - Accuracy of Patient Hours measurement (compliance meter) may be affected as a result of unreliable SmartStart and Mask Alarm functions
  - Some masks may add to circuit resistance and potentially increase the work of breathing.

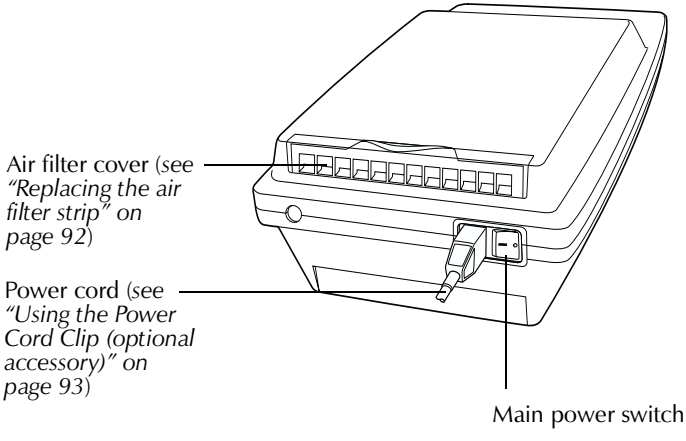
- The mask should be worn only when the machine is turned on and operating properly. Explanation: exhaled air is flushed out of the vents when the machine is operating. If the unit is not operating, exhaled air will be rebreathed. The vent holes on the mask should never be blocked.
- At low pressures, especially at low EPAP pressures, the flow through the exhalation ports may be inadequate to clear all exhaled gases. Some rebreathing may occur.
- The airflow for breathing may be as much as 11°F (6°C) higher than room temperature. Caution should be exercised if the room temperature is higher than 95°F (35°C).
- Do not drop or insert any objects into the air tubing or air outlet.
- Do not open the flow generator case or attempt to adjust the unit.

DIAGRAMS

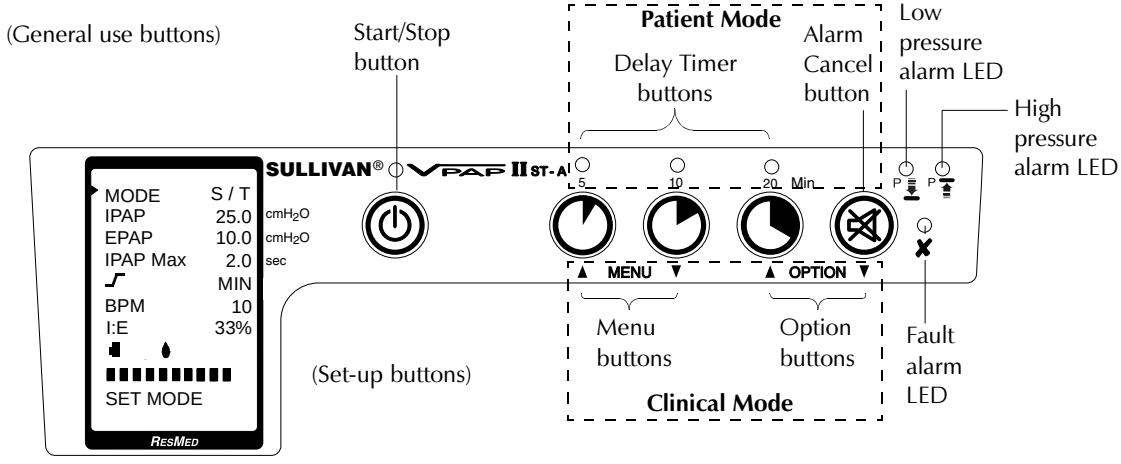
FRONT VIEW



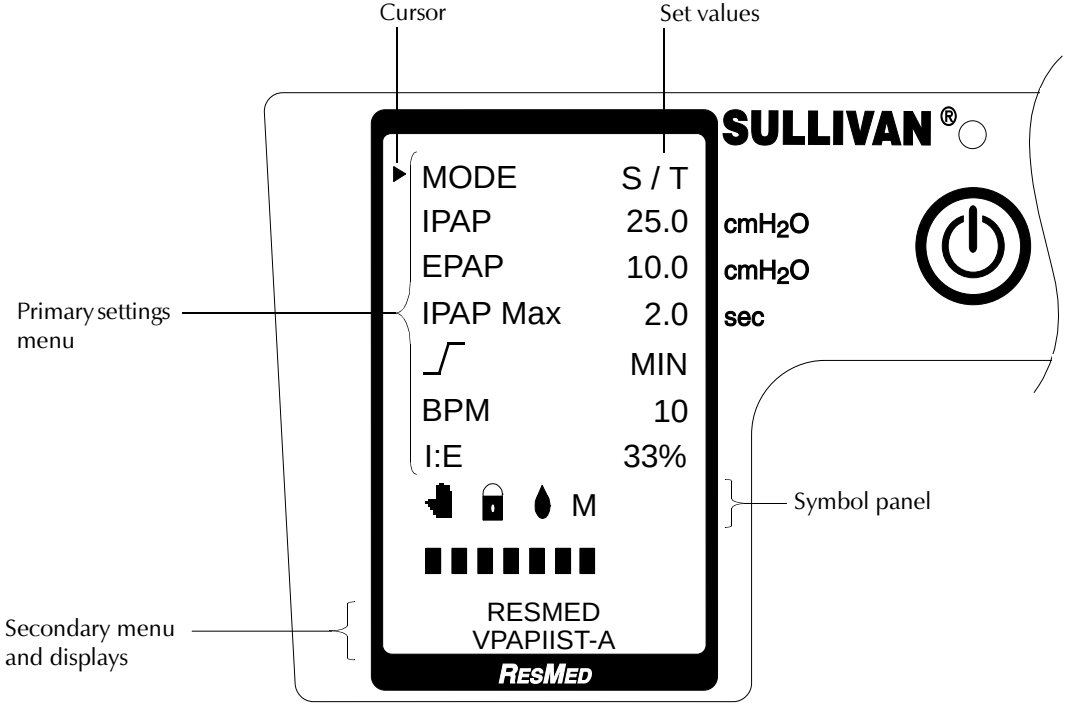
REAR VIEW



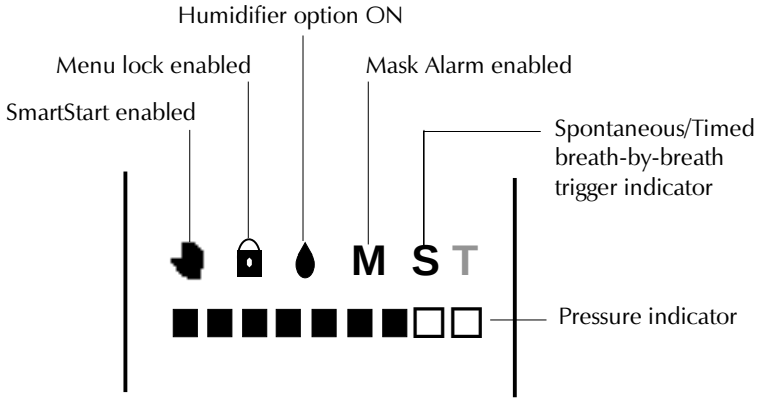
CONTROL PANEL DETAIL



LCD SCREEN DETAIL



SYMBOL PANEL DETAIL



PRINCIPLES OF OPERATION

OPERATING MODES

The VPAP II ST-A provides a higher pressure during inhalation (IPAP) and a lower pressure during exhalation (EPAP). The VPAP II ST-A has three operating modes which determine how the changes between IPAP and EPAP pressures are made: Spontaneous, Spontaneous/Timed, and Timed. The VPAP II ST-A also has a CPAP mode in which a fixed pressure is delivered.

- In Spontaneous mode, the VPAP II ST-A senses when the patient breathes in and when the patient breathes out. The ventilator follows the patient's spontaneous breathing rate to supply the appropriate pressure.
- In Spontaneous/Timed mode, the VPAP II ST-A will follow the patient's spontaneous breathing (as in Spontaneous mode). However, the clinician also specifies a breathing rate (as in Timed mode) which they do not want the patient to fall below. This is a backup rate, which will be supplied if the patient's spontaneous breathing rate becomes insufficient.
- In Timed mode, the clinician sets a breathing rate and an inspiratory time (as set by the IPAP Max parameter). This fixed rate is supplied to the patient at the fixed inspiratory time.
- In CPAP mode, a fixed pressure is delivered.

For further information on these modes see "Ventilator Settings" on page 21.

TRIGGERING AND CYCLING

To provide effective ventilation it is important to maximize the synchronization between the breathing rhythm of the patient and the pressure pattern supplied by the ventilator. Synchronization is achieved by the ventilator quickly and reliably detecting when the patient inhales and when the patient exhales.
The VPAP II ST-A uses pressure and flow transducers to accurately sense the patient's inhalation and exhalation efforts.

The VPAP II ST-A detects the beginning of the patient's inspiratory effort by measuring the increase in flow. When inspiratory flow increases above a certain level the device changes from EPAP to IPAP. This change from EPAP to IPAP is called triggering.

Similarly, the VPAP II ST-A changes from IPAP to EPAP when the inspiratory flow decreases below a certain level. The change from IPAP to EPAP is called cycling.

For further details see "Synchronization" on page 49.

Vsync™ – Automatic Leak Management

Vsync is the automatic leak management algorithm unique to the VPAP II Series. Vsync monitors and compensates for leak by continuously and automatically adjusting the baseline flow thereby maintaining reliable triggering and cycling.

For further details see “Vsync: Automatic Leak management – Trigger/Cycle Threshold Adjustment” on page 50.

T_iCONTROL™ – Inspiratory Time Control

The T_iCONTROL feature which is also unique to the VPAP II Series, allows the clinician to set minimum and maximum limits on the time the ventilator spends in IPAP. The minimum and maximum time limits are set at either side of the patient’s ideal spontaneous inspiratory time, providing a “window of opportunity” for the patient to spontaneously cycle to EPAP.

The minimum time limit is set via the IPAP Min™ Time parameter and the maximum time limit is set via the IPAP Max™ Time parameter.

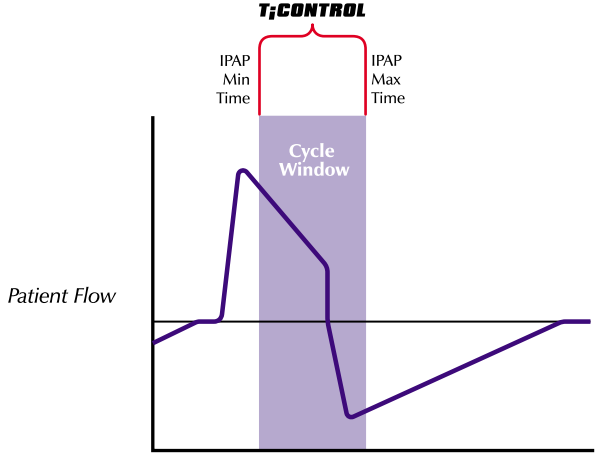


Figure 2: T_iCONTROL (IPAP Min and IPAP Max Time Parameters) sets the Cycle Window

T_iCONTROL’s IPAP Max and IPAP Min Time parameters play a significant role in maximizing synchronization by effectively intervening to limit or prolong the inspiratory time when required. This provides the clinician with the flexibility to manage different disease states as well as ensuring synchronization even in the presence of large mouth and/or mask leak.

For further details see “TiCONTROL: Inspiratory Time Control” on page 51.

RISE TIME ADJUSTMENT

Rise Time is the time taken for the pressure to increase from EPAP up to IPAP. Rise Time can be set to MIN (the fastest Rise Time) and then in 50 unit increments from 150msec to 900msec. This will control the rate of pressure increase when the VPAP II ST-A switches from EPAP to IPAP. The higher the Rise Time setting, the longer it takes for the pressure to increase from EPAP to IPAP. Generally, this feature is adjusted to achieve maximum patient comfort. The patient should feel they are receiving adequate flow without being startled by each transition to the IPAP level. However, if the patient has a high ventilatory demand then setting the Rise Time to MIN will help lower the patient's work of breathing as this is the fastest Rise Time setting.

NOTE

The Rise Time should be set less than the patient's inspiratory time, otherwise the patient will not spend any time at the IPAP pressure and ventilation could be affected. A safety feature of the VPAP II ST-A does not allow Rise Time to exceed the IPAP Max time setting.

The Rise Time scale approximates the time taken (in msec) for the pressure to increase from 10% to 90% of the IPAP-EPAP pressure difference under controlled conditions. Range: 90 msec (nominal) to 900 msec

For further details see "Ventilator parameter settings for selected mode" on page 26.

PRESSURE DELIVERY

The VPAP II ST-A dynamically adjusts for pressure fluctuations by constantly measuring the delivered pressure and comparing this to the set pressure. The delivered pressure is measured internally using pressure transducers. Adjustments are made approximately 80 times a second allowing the VPAP II ST-A to rapidly accommodate changing leak and flow conditions while maintaining a constant pressure.

DEVICE ALARMS

The VPAP II ST-A is equipped with an audible alarm and three warning lights to indicate a device malfunction that may affect treatment. The alarms are for low pressure, high pressure, power failure or disconnection and overheating.

For further details see "Alarms and Warning Lights" on page 73.

MASK ALARM

The VPAP II ST-A also has an optional mask off alarm which will activate in the presence of excessive leak. A “Mask off” message will also appear on the LCD screen. The mask off alarm can be enabled or disabled via the Mask Alarm menu.

For further details see “Mask Alarm” on page 75.

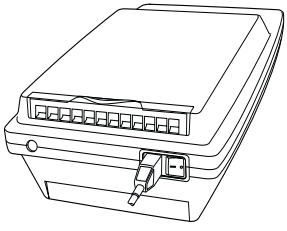
ASSEMBLY

1

Check that you have the following items:

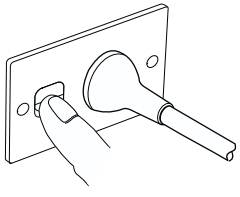
- VPAP II ST-A device
- Air tubing
- Power cord
- Carry bag.

2



Plug the power cord into the power socket at the back of the VPAP II ST-A.

3



Plug the other end of the power cord into a mains power outlet.

4

Select an appropriate ResMed mask system (see “Choosing a Mask” on page 17) and assemble it according to the user instructions supplied with the mask.

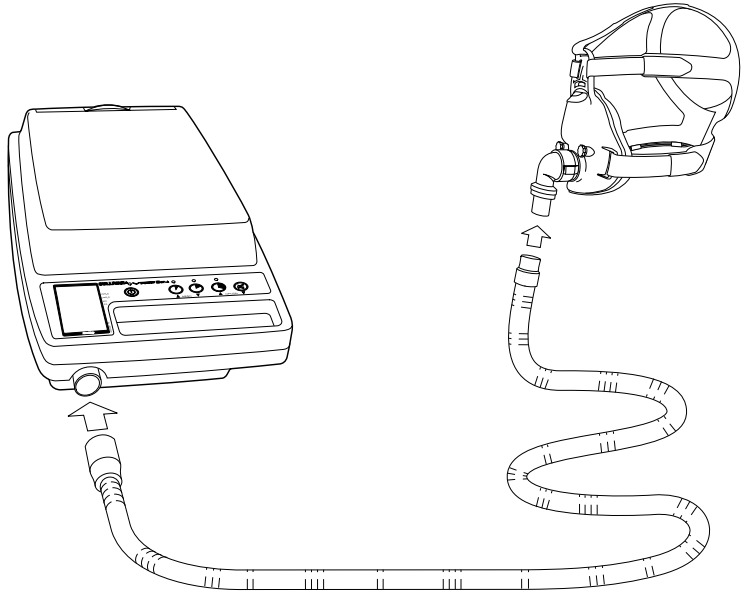
If you choose to use a humidifier, refer to the user’s manual supplied with the humidifier for connection instructions. Also see “Humidification” on page 61.

WARNING

The VPAP II ST-A should only be used with humidifiers recommended by ResMed, or by a physician or respiratory therapist.

5

Connect one end of the air tube to the outlet on the VPAP II ST-A or humidifier if used. Connect the other end to the mask system.



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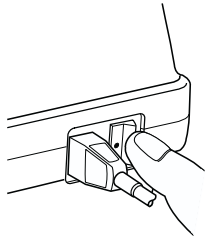


Turn the power switch on (I).

The VPAP II ST-A is now assembled.

Before use, you will need to select the appropriate mode and set the operating parameters. See “Ventilator parameter settings for selected mode” on page 26.

SYSTEM SET-UP

CHOOSING A MASK

For best results with mask ventilatory support, an appropriate well-fitted and comfortable mask is necessary to ensure ongoing tolerance to therapy and effectiveness of therapy.

If patients using a nasal mask are unable to maintain an effective lip seal, and either the quality of ventilation or sleep is affected, they should then try a nose/mouth or full face mask such as the MIRAGE® FULL FACE MASK. The MIRAGE FULL FACE MASK comes in several sizes with shallow versions available.

NOTE

For details on fitting your mask, refer to your mask User's Guide. For details on recommended masks contact your local ResMed office.

WARNING

The VPAP II-ST-A should only be used with vented mask systems recommended by ResMed, or by a physician or respiratory therapist. See "WARNINGS" on page 4.

SKIN CARE

Pressure area care is an important aspect of NPPV. Damage to the skin, especially across the nasal bridge, is most likely to occur if NPPV is used on an almost continuous basis. However, it can also occur in patients who are unable to reposition the mask themselves because of upper limb weakness. Patients who are on high dose oral steroids may also have an increased likelihood of skin problems, and such patients need to be monitored for signs of skin breakdown.

Taking a preventative approach to avoid skin breakdown in the first place is important. Masks need to be carefully fitted so that comfort and minimal leaks are achieved. Frequently, the use of an ULTRA MIRAGE™ or MIRAGE FULL FACE MASK can achieve both these goals. The use of a protective dressing can also alleviate irritation to the skin.

If the skin does become reddened, the area should be gently massaged, and the mask fit reassessed. Check that the head-straps are not over tightened.

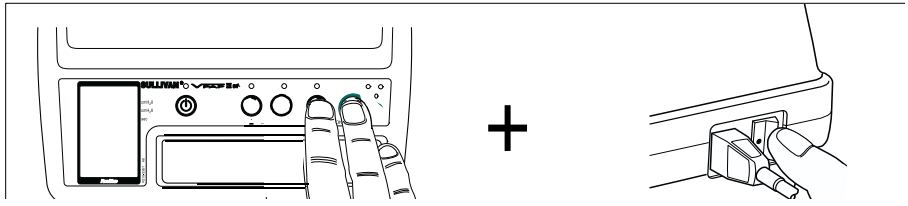
If a patient requires ventilatory support for prolonged periods, the mask should be removed periodically to examine the skin, for pressure area care and for placement of a protective dressing if required. If patients require mask use on a continuous basis, alternating between several styles of mask may also be of value.

VPAP II ST-A SET-UP

STEP 1

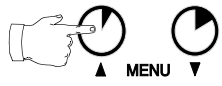
The VPAP II ST-A can be set-up using the display and buttons on the device itself or with the use of a separate control unit – the RESCONTROL. To set-up the VPAP II ST-A using the RESCONTROL, see "Using a ResControl" on page 65.

The VPAP II ST-A is set using the menus on the LCD screen. To access the set-up menus, turn the VPAP II ST-A on while holding down the **two right hand side buttons** on the control panel until CLINICAL MODE appears on the bottom of the LCD.



STEP 2

Select the menu items, using the ▲ **MENU** ▼ buttons. The settings menu items are shown in Table 1 on page 19. The first seven items are in the "Primary Settings menu" shown on the main screen of the LCD with a movable cursor, while the rest appear in the secondary menu as text at the bottom of the screen in the message panel.



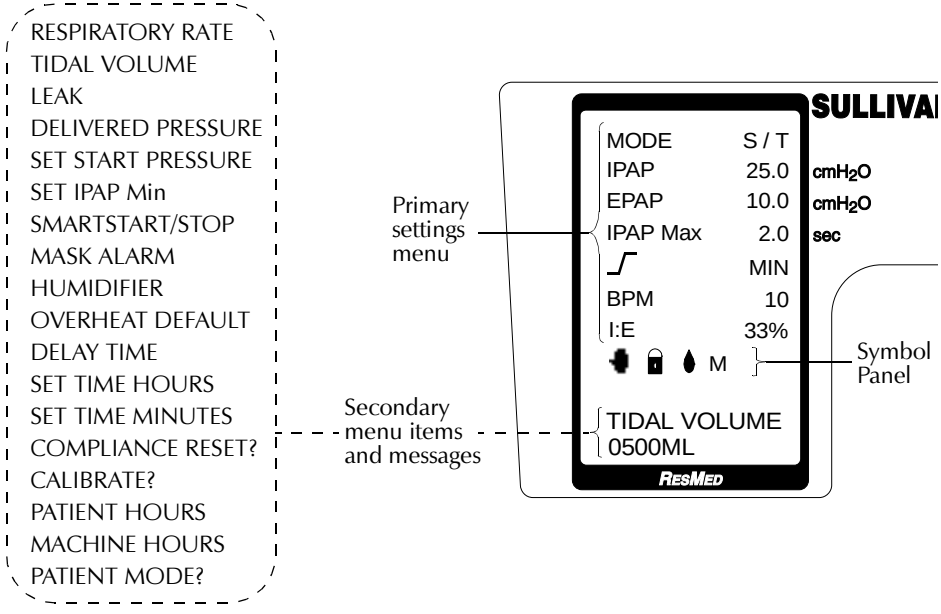


Figure 3: Overview of VPAP II ST-A Primary and Secondary menus

To change a setting, press the ▲ **OPTION** ▼ buttons to select the desired value or status. The settable range and default values for each menu are also shown in Table 1 on page 19.

STEP 3

If you are setting the VPAP II ST-A for home treatment, you must lock the menu after set-up before giving the VPAP II ST-A to the patient. To do this:

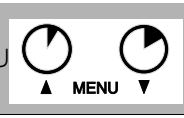
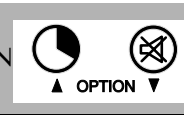
1. Use the ▲ **MENU** ▼ buttons to select the PATIENT MODE in the secondary menu.
2. Press the ▲ **OPTION** button to answer YES. The display will ask ARE YOU SURE?
3. Press the ▲ **OPTION** button again to answer YES and the menus will be locked.
4. To return to the clinical mode, turn the VPAP II ST-A off and refer to STEP 1.

NOTE

You do not need to lock the menu in the clinical mode. It is more useful to have the menu readily accessible. The menu lock is to prevent patients from changing the settings at home.

Table 1: VPAP II ST-A menu, maximum and minimum values, adjustment increments and default values

MENU ▲ MENU ▼	OPTION ▲ OPTION ▼	DEFAULT
SET MODE	CP S T S/T	S / T
SET IPAP	2–25 cm H_2O (0.2 increment)	10 cm H_2O
SET EPAP	2 cm H_2O–IPAP (0.2 increment)	8 cm H_2O
SET IPAP Max	0.1–3.0 sec (S & S/T modes) 0.1–10.8 sec (T mode)	2.0 sec
SET RISE TIME	MIN, 150–900 (50 increment)	MIN
SET BPM	5–30 BPM (1 sec increment)	10 BPM
I:E	DISPLAY ONLY	33%
RESPIRATORY RATE	DISPLAY ONLY	N/A
TIDAL VOLUME	DISPLAY ONLY	N/A
LEAK	DISPLAY ONLY	N/A
DELIVERED PRESSURE	DISPLAY ONLY	N/A

MENU 	OPTION 	DEFAULT
SET START PRESSURE	2 cm H_2O – EPAP (0.2 increment)	4.0 cm H_2O
SET IPAP Min	0.1 sec–IPAP Max (0.1 increment)	0.1 sec
SMARTSTART/STOP	ON/OFF	OFF
MASK ALARM	ON/OFF	ON
HUMIDIFIER	ON/OFF	OFF
OVERHEAT DEFAULT	IPAP OR EPAP	*EPAP
DELAY TIME	add/remove 0, 5, 10, 20	0
SET TIME HOURS	± 1 hour	user set
SET TIME MINUTES	± 1 minute	user set
COMPLIANCE RESET?	YES Are You Sure?	N/A
CALIBRATE?	YES Are You Sure?	N/A
PATIENT HOURS	DISPLAY ONLY	00000
MACHINE HOURS	DISPLAY ONLY	00000
PATIENT MODE?	YES to lock menu	menu locked

* If using the ResAlarm II see “Overheating” on page 92.

Ventilator Settings

Description of modes

The following four diagrams illustrate the four modes of operation available on the VPAP II ST-A. Each diagram depicts three measurements on the vertical axis; Respiratory Effort using Electromyogram (EMG) Diaphragm, Patient Flow (L/min) and Mask Pressure (cm H_2O.) The horizontal axis depicts units of time in seconds.

Spontaneous mode (S mode)

In this mode the VPAP II ST-A senses when the patient breathes in and when the patient breathes out. The device follows the patient's spontaneous breathing rate to supply the appropriate pressure. The spontaneous mode is used when the patient is able to trigger the device to IPAP consistently, both awake and asleep, without developing periods of apnea. Although the patient has primary breath control and cycling to EPAP will usually occur spontaneously, T_iCONTROL's IPAP Min and IPAP Max Time parameters can be used to provide minimum and maximum limits on the inspiratory time. For further details see "TiCONTROL: Inspiratory Time Control" on page 51.

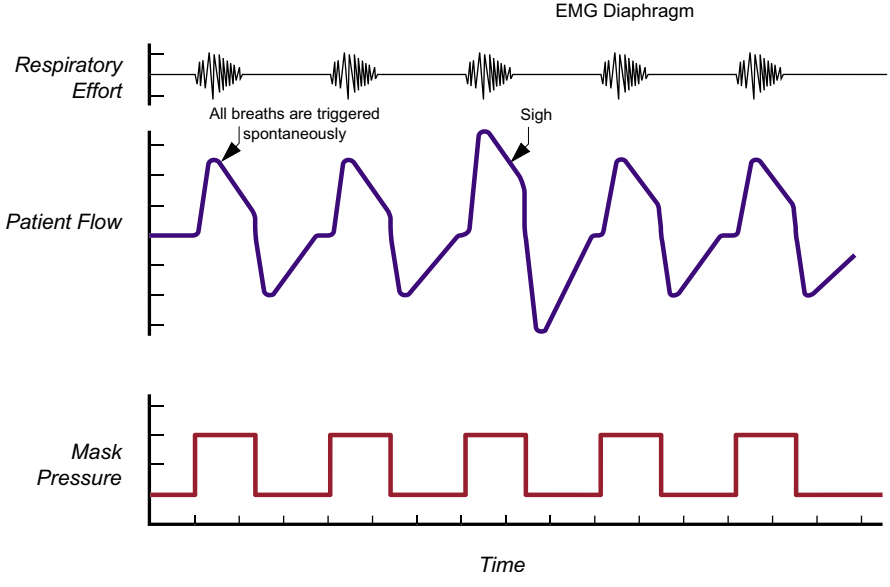


Figure 4: Spontaneous mode

SPONTANEOUS/TIMED MODE (S/T MODE)

In this mode the VPAP II ST-A will follow the patient's spontaneous breathing (as in Spontaneous mode). However, the clinician also specifies a breathing rate which they do not want the patient to fall below. This is a backup rate, which will be supplied if the patient's spontaneous breathing rate becomes insufficient. This mode is used when a clinician wants to ensure a minimum backup rate is secured, when the patient is not able to trigger the machine consistently, or when the basal respiratory rate is very low. When set in this mode, the device will augment any breath initiated by the patient, but will also deliver additional breaths should the respiratory rate fall below the clinician set "backup" breath rate. T_iCONTROL's IPAP Min and IPAP Max Time parameters can be used to provide minimum and maximum limits on the inspiratory time, however, as in spontaneous mode, the patient has primary breath control and cycling will usually occur spontaneously for both Spontaneous and backup (Timed) breaths. For further details see "TiCONTROL: Inspiratory Time Control" on page 51.

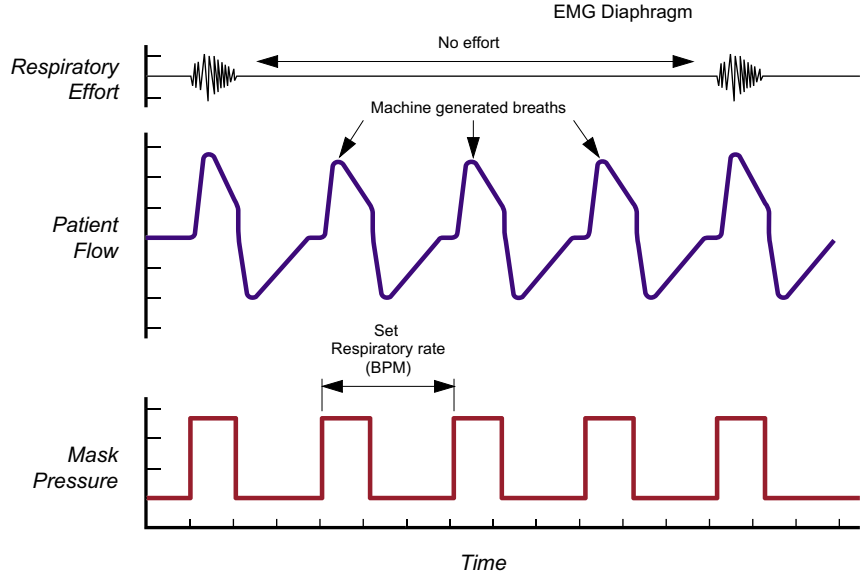


Figure 5: Spontaneous/Timed mode

Timed mode (T mode)

In this mode the clinician sets the breathing rate and an inspiratory time. The timed mode is used when a fixed inspiratory time and respiratory rate is desired and the patient is not able to trigger the device consistently or the basal respiratory rate is very low. It is important to note that the Timed mode is a “controlled” mode, not dependent on the breathing effort of the patient, should such effort exist.

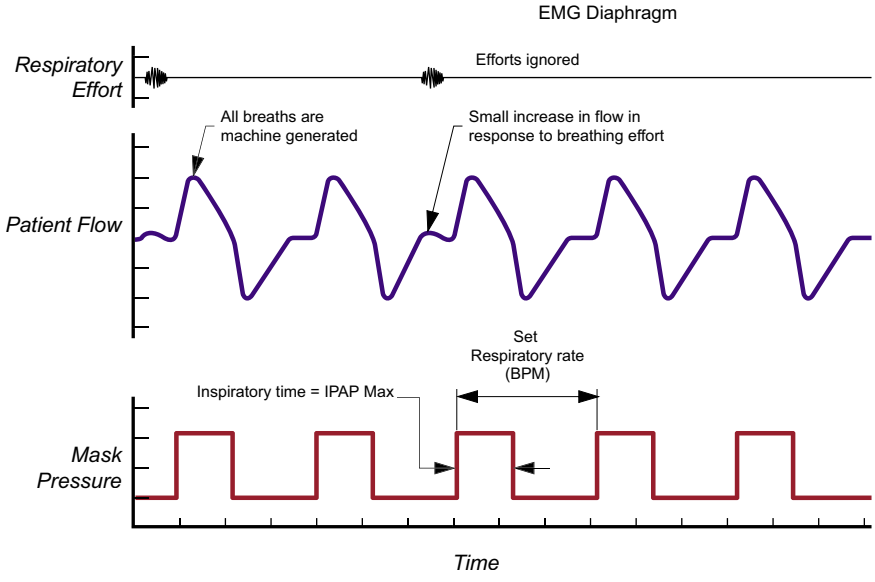


Figure 6: Timed mode

CPAP (CP MODE)

In CPAP mode, a fixed pressure is delivered. The CPAP mode is often used in patients with obstructive sleep apnea (OSA) who require no tidal volume augmentation.

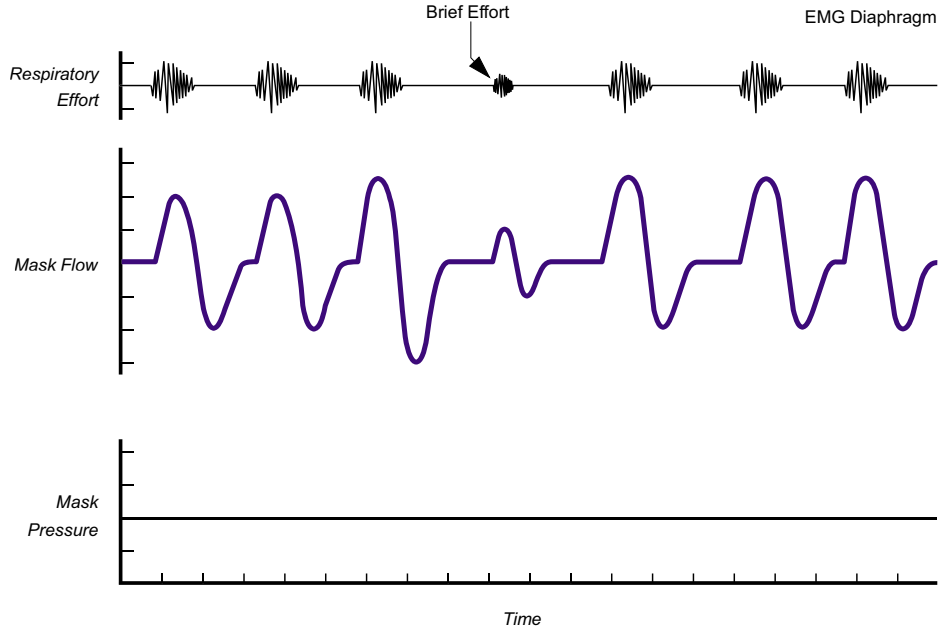


Figure 7: CPAP mode

CHOOSING A MODE OF VENTILATORY SUPPORT

If an individual is able to trigger the device into the IPAP pressure consistently, without developing periods of apnea, then the Spontaneous mode is appropriate. It is important to know if a patient is able to trigger the device asleep as well as when awake. A failure to trigger the device into IPAP may be due to upper airway obstruction or the presence of intrinsic PEEP. The EPAP pressure should be titrated to abolish obstructive events and/or overcome intrinsic PEEP. However, if the patient is not able to trigger the machine consistently, or if the basal respiratory rate is very low, then the Spontaneous/Timed mode is more appropriate.

The mode used by the clinician can also be influenced by the therapeutic goals of treatment. If the aim of therapy is to rest the respiratory muscles then the Spontaneous/Timed mode may be applicable. However, if supporting and augmenting the patient's own respiratory efforts is required, then the Spontaneous mode may be more appropriate.

The Timed mode is used when a fixed inspiratory time and respiratory rate is desired, and the patient is not able to trigger the device consistently, or the basal respiratory rate is very low.

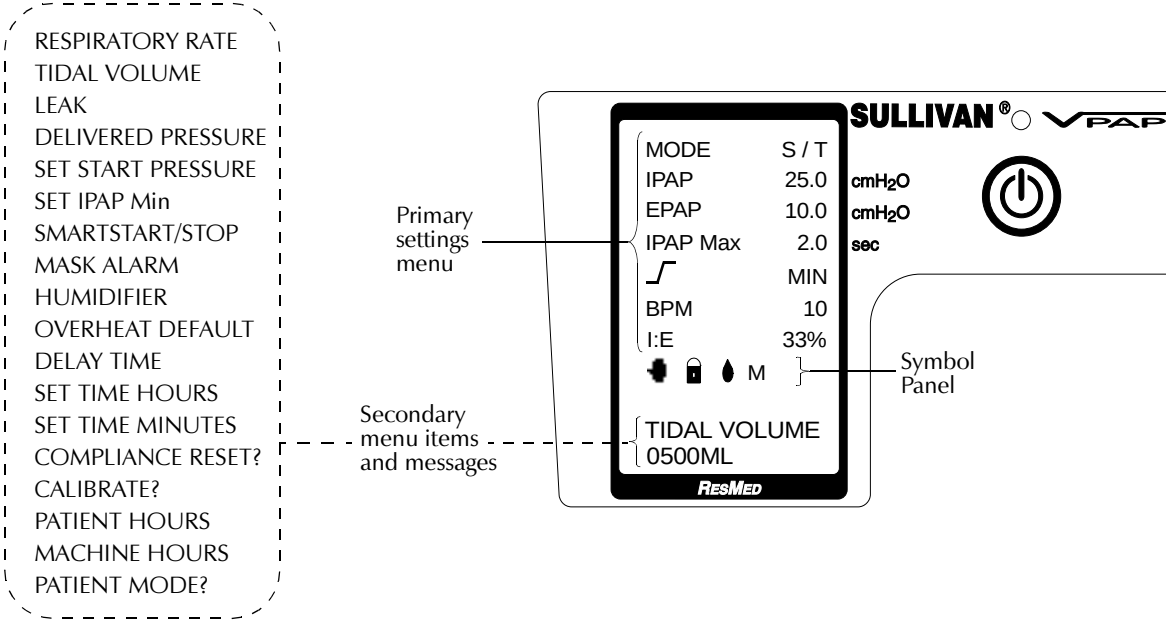
The CPAP mode is often used in patients who have OSA and who require no tidal volume augmentation. Some patients with uncomplicated OSA may fail to tolerate CPAP, especially when prescribed high treatment pressures. These patients may find the VPAP II ST-A in S mode more comfortable as the pressure is lowered to EPAP during exhalation.

WARNING

Care should be taken not to over-ventilate patients using the Spontaneous/Timed, Spontaneous or Timed modes of ventilation, as this may induce glottic closure resulting in airway obstruction.

VENTILATOR PARAMETER SETTINGS FOR SELECTED MODE

OVERVIEW OF VPAP II ST-A PRIMARY AND SECONDARY MENUS



Spontaneous Mode

This section discusses the key parameters that need to be adjusted, and the monitored items that are displayed in Spontaneous mode.

The key adjustable parameters in this mode are:

- IPAP
- EPAP
- IPAP Max
- Rise Time
- IPAP Min

The monitored parameters displayed in this mode are:

- Respiratory Rate
- Tidal Volume
- Leak
- Pressure

The key adjustable parameters and monitored parameters are discussed below in the order they appear in the VPAP II ST-A primary and secondary menus. For instructions on how to change settings see "VPAP II ST-A Set-up" on page 18.

For other adjustable device settings and displayed items available in this mode, see "Additional Functions" on page 69.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
MODE **"S"** *(Primary menu)*	In the Spontaneous mode, the VPAP II ST-A senses when the patient breathes in and when the patient breathes out. The device follows the patient's spontaneous breathing rate to supply the appropriate pressure. In this mode, an "S" icon will briefly appear beneath the I:E value on the LCD screen to indicate the initiation of IPAP for each breath detected by the VPAP II ST-A.	The Spontaneous mode is used when the patient is able to trigger the device to IPAP consistently, both awake and asleep, without developing periods of apnea. The Spontaneous mode is used to support and augment the patient's own respiratory efforts.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
IPAP *(Primary menu)*	The IPAP (Inspiratory Positive Airway Pressure) setting ranges from 2 to 25 cm H_2O. This is the amount of pressure in the circuit during the patient's inspiratory phase. The difference between the IPAP and EPAP (IPAP-EPAP) determines the pressure support level delivered to the patient. Triggering to IPAP will occur as the result of patient effort in the Spontaneous mode. See "Operating Modes" on page 11 for details on cycling to EPAP.	The setting of the inspiratory pressure is made on the basis of patient tolerance and the effect of the pressure on ventilation and gas exchange. As the IPAP pressure is increased and the difference between IPAP and EPAP widens, the tidal volume will normally be increased. The changes in IPAP and tidal volume can both be observed on the LCD screen. It should be noted however, that unnecessarily high inspiratory pressure can worsen leak from the mask and mouth, thereby reducing the effectiveness of ventilatory support. These leaks will most likely occur in patients with very stiff lungs or chest walls, or in patients with weak facial muscles. If patients are unable to tolerate the desired IPAP level initially, gradual increases in pressure may need to occur over time. The Tidal Volume measurement which can be found in the secondary menu can be used as a guide to setting the IPAP level. For guidelines on adjusting IPAP settings, see "Set-up Flow Chart (S and S/T Mode)" on page 57. NOTE: Before starting treatment, make sure the Delay Timer setting is correct. For further details, see "Delay Timer" on page 80.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
EPAP *(Primary menu)*	The EPAP (Expiratory Positive Airway Pressure), also known as EEP or PEEP, setting ranges from 2 cm H_2O to the set IPAP level. This is the amount of pressure in the circuit during the patient's expiratory phase.	EPAP is used to: • assist flushing of exhaled CO_2 through the mask vents during exhalation, • maintain patency of the upper airway, especially important during sleep, • overcome intrinsic PEEP in patients with obstructive lung disease, and • improve oxygenation and end expiratory lung volumes in patients with low lung volumes. For guidelines on adjusting EPAP settings, see "Set-up Flow Chart (S and S/T Mode)" on page 57.
IPAP Max *(Primary menu)*	IPAP Max Time is a TiCONTROL parameter. It allows adjustment of maximum inspiratory time parameter ranging from 0.1 to 3 seconds for Spontaneous mode. NOTE: In Spontaneous mode, although it is possible to set an IPAP Max Time greater than 3 seconds the VPAP II ST-A internally limits the IPAP Max Time to 3 seconds.	The IPAP Max Time parameter allows the clinician to limit the time the patient spends in IPAP. The ability to limit the maximum inspiratory time is an important factor in optimizing patient/ventilator synchronization. Refer to "Synchronization" on page 49 for details on how to set the IPAP Max parameter to optimize synchronization in the presence of mask and/or mouth leaks, and in patients with different disease states. For details on adjusting IPAP Max settings, see "TiCONTROL: IPAP Min and IPAP Max time Calculation Guide" on page 58. For details on synchronization see "Synchronization" on page 49.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
Rise Time *(Primary menu)*	Rise Time is the time taken for the pressure to increase from EPAP to IPAP*. The VPAP II ST-A allows the Rise Time to be set to MIN (the fastest or shortest Rise Time). It can also be set in 50 millisecond increments from 150 to 900. The higher the Rise Time setting, the longer it takes for the pressure to increase from EPAP to IPAP. *NOTE: The Rise Time scale approximates the time taken (in milliseconds) for the pressure to increase from 10% to 90% of the IPAP-EPAP pressure difference under controlled conditions. Range: 90 msec (nominal) to 900 msec	Generally, Rise Time is adjusted to achieve maximum patient comfort. The patient should feel that they are receiving adequate flow but not be startled by each transition to the IPAP level. However, if the patient has a high ventilatory demand (eg. patients with respiratory insufficiency) then setting the Rise Time to MIN will help lower the patient's work of breathing. For example, a MIN Rise Time setting can help patients with respiratory insufficiency. Consideration of the patient's actual inspiratory time will also help guide where to set the Rise Time. Setting the Rise Time too long can limit the time spent at IPAP and could impair ventilation. For example, if a patient's inspiratory time is one second, a Rise Time setting of less than 350 msec is recommended, allowing sufficient time for ventilation at IPAP.
Respiratory Rate (Secondary menu)	*Monitored Parameter* This is a display of the respiratory rate based on the last two breaths detected by the VPAP II ST-A.	
Tidal Volume *(Secondary menu)*	*Monitored Parameter* This is a display of the calculated tidal volume delivered to the patient by the VPAP II ST-A. It is calculated on a breath-by-breath basis by integrating an estimate of patient flow, obtained by subtracting the leak flow and ResMed mask vent flow from the measured total flow rate.	This provides a useful indication of the trend and magnitude of change in the patient's tidal volume. Tidal volume will normally increase as IPAP pressure is increased. Since the VPAP II ST-A assumes the vent flow to be that of a ResMed mask when performing calculations, using masks other than ResMed masks is likely to diminish accuracy in this display. Unintentional leak has a similar effect on these calculations. There will be some delay in the display of the Tidal Volume measurement after being selected.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
Leak *(Secondary menu)*	*Monitored Parameter* This is a display of leak as calculated by the VPAP II ST-A. It is a measure of additional airflow required to compensate for unintentional leak around the mask and/or through the patient's mouth. Since the VPAP II ST-A knows the expected vent flow of ResMed masks, it calculates any additional flow at the end of exhalation as leak. It is expressed in liters per minute (L/min) and updated continuously.	Ideally, leak rates should be kept below 25 L/min, to assure quality sleep[a]. Non-ResMed masks may yield erroneous leak calculations. Even then, the ResMed VPAP II ST-A will yield a useful indication of the trend and magnitude of change. There will be some delay in the display of the leak value after being selected. NOTE: The leak display provides an estimate and is for trending purposes only.
Pressure *(Secondary menu)*	*Monitored Parameter* This is a display of pressure delivered from the VPAP II ST-A. Delivered pressure is measured internally by a pressure transducer.	
IPAP Min *(Secondary menu)*	IPAP Min Time is a TiCONTROL parameter. It allows adjustment of the minimum inspiratory time parameter ranging from 0.1secs to IPAP Max for Spontaneous mode. IPAP Min Time is the minimum duration of time that the device will remain at the IPAP level.	The IPAP Min Time parameter allows the clinician to set a minimum time the patient spends in IPAP. The ability to set the minimum IPAP time is an important factor in optimizing patient/ventilator synchronization for patients with restrictive diseases. For details on adjusting IPAP Min settings, see "TiCONTROL: IPAP Min and IPAP Max time Calculation Guide" on page 58.

a. Thomas J. Meyer, Mark R. Pressma, Joshua Benditt, Francis D. McCool, Richard P. Millman, Ranjini Natarajan, Nicholas S. Hill, Air Leaking Through the Mouth During Nocturnal Nasal Ventilation: Effect on Sleep Quality. *Sleep*1997; 20(7):561-569.

For other adjustable device settings and displayed items available in this mode, see "Additional Functions" on page 69. These include:

- SET START PRESSURE
- SMARTSTART/STOP
- MASK ALARM
- HUMIDIFIER
- OVERHEAT DEFAULT
- DELAY TIME

SPONTANEOUS/TIMED MODE

This section discusses the key parameters that need to be adjusted, and the monitored items that are displayed in Spontaneous/Timed mode.

The key adjustable parameters in this mode are:

- IPAP
- EPAP
- IPAP Max
- Rise Time
- BPM
- I:E ratio (this is a display-only item, but is dependent upon the IPAP Max and BPM settings)
- IPAP Min

The monitored parameters displayed in this mode are:

- Respiratory Rate
- Tidal Volume
- Leak
- Pressure

The key adjustable parameters and monitored parameters are discussed below in the order they appear in the VPAP II ST-A primary and secondary menus. For instructions on how to change settings see “VPAP II ST-A Set-up” on page 18.

For other adjustable device settings and displayed items available in this mode, see “Additional Functions” on page 69.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
MODE **"S/T"** *(Primary menu)*	In Spontaneous/Timed mode, the VPAP II ST-A will follow the patient's spontaneous breathing (as in Spontaneous mode). However, the clinician also specifies a breathing rate (refer BPM setting below), which they do not want the patient to fall below. This is a backup rate, which will be supplied if the patient's spontaneous breathing rate becomes insufficient. In this mode, one of two icons will briefly appear beneath the I:E value on the LCD screen to indicate the event which triggered the EPAP to IPAP transition. They are "S" (patient-initiated or "spontaneous" inspiration) and "T" (time-initiated or "backup" machine breath).	The spontaneous/timed mode is used when: • the security of a minimum backup rate is required, • the patient is not able to trigger the machine consistently or • the basal respiratory rate is very low.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
IPAP *(Primary menu)*	The IPAP (Inspiratory Positive Airway Pressure) setting ranges from 2 to 25 cm H_2O. This is the inspiratory pressure, which will be delivered to the patient when the device is triggered into inspiration. The difference between the IPAP and EPAP (IPAP-EPAP) determines the pressure support level delivered to the patient. Triggering to IPAP will occur as a result of either: • patient effort (spontaneous trigger) or • the patient's respiratory rate falling below the backup breath rate (time triggered) such as in the event of apnea or hypopnea. See "Operating Modes" on page 11 for details on cycling to EPAP.	The setting of the inspiratory pressure is made on the basis of patient tolerance and the effect of the pressure on ventilation and gas exchange. As the IPAP pressure is increased and the difference between IPAP and EPAP widens, the tidal volume will normally be increased. The changes in IPAP and Tidal Volume can both be observed on the LCD screen. It should be noted however, that unnecessarily high inspiratory pressure can produce worsening leak from the mask and mouth, thereby reducing the effectiveness of ventilatory support. These leaks will most likely occur in patients with very stiff lungs or chest walls, or in patients with weak facial muscles. If patients are unable to tolerate the desired IPAP level initially, gradual increases in pressure may need to occur over time. The Tidal Volume measurement which can be found in the secondary menu can be used as a guide to setting the IPAP level. For guidelines on adjusting IPAP settings, see "Set-up Flow Chart (S and S/T Mode)" on page 57. NOTE: Before starting treatment, make sure the Delay Timer setting is correct. For further details, see "Delay Timer" on page 80.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
EPAP *(Primary menu)*	The EPAP (Expiratory Positive Airway Pressure) setting ranges from 2 cm H_2O to the set IPAP level. This is the amount of pressure in the circuit during the patient's expiratory phase.	EPAP is used to: • assist flushing of exhaled CO_2 through the mask vents during exhalation, • maintain patency of the upper airway, especially important during sleep, • overcome intrinsic PEEP in patients with obstructive lung disease, and • improve oxygenation and end expiratory lung volumes in patients with low lung volumes. For guidelines on adjusting EPAP settings, see "Set-up Flow Chart (S and S/T Mode)" on page 57.
IPAP Max *(Primary menu)*	IPAP Max Time is a TiCONTROL parameter. It allows adjustment of maximum inspiratory time parameter ranging from 0.1 to 3 seconds for Spontaneous/Timed mode. NOTE: In Spontaneous/Timed mode, although it is possible to set an IPAP Max Time greater than 3 seconds the VPAP II ST-A internally limits the IPAP Max Time to 3 seconds.	The IPAP Max Time parameter allows the clinician to limit the time the patient spends in IPAP. The ability to limit the maximum inspiratory time is an important factor in optimizing patient/ventilator synchronization. Refer to "Synchronization" on page 49 for details on how to set the IPAP Max parameter to optimize synchronization in the presence of mask and/or mouth leaks, and in patients with different disease states. exchange and reduced compliance. For details on adjusting IPAP Max settings, see "TiCONTROL: IPAP Min and IPAP Max time Calculation Guide" on page 58. For details on synchronization see "Synchronization" on page 49.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
Rise Time *(Primary menu)*	Rise Time is the time taken for the pressure to increase from EPAP to IPAP*. The VPAP II ST-A allows the Rise Time to be set to MIN (the fastest or shortest Rise Time). It can also be set in 50 millisecond increments from 150 to 900. The higher the Rise Time setting, the longer it takes for the pressure to increase from EPAP to IPAP. *NOTE: The Rise Time scale approximates the time taken (in milliseconds) for the pressure to increase from 10% to 90% of the IPAP-EPAP pressure difference under controlled conditions. Range: 90 msec (nominal) to 900 msec	Generally, Rise Time is adjusted to achieve maximum patient comfort. The patient should feel that they are receiving adequate flow but not be startled by each transition to the IPAP level. However, if the patient has a high ventilatory demand (eg. patients with respiratory insufficiency) then setting the Rise Time to MIN will help lower the patient's work of breathing. For example, a MIN Rise Time setting can help patients with respiratory insufficiency. Consideration of the patient's actual inspiratory time will also help guide where to set the Rise Time. Setting the Rise Time too long can limit the time spent at IPAP and could impair ventilation. For example, if a patient's inspiratory time is one second, a Rise Time setting of less than 350 msec is recommended, allowing sufficient time for ventilation at IPAP.
BPM *(Primary menu)*	This parameter sets the Breaths Per Minute (BPM) or "backup" Rate. The BPM rate ranges from 5–30 breaths per minute.	In the Spontaneous/Timed mode, the BPM rate is set as a "backup" rate when: • the security of a minimum backup rate is required, • the patient is not able to trigger the machine consistently or • the basal respiratory rate is very low. The rate is usually set slightly lower than the patient's respiratory rate during quiet ventilation. To check the patient's respiratory rate, see "Measuring Respiratory Rate" on page 59.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
I:E Display *(Primary menu)*	*Display Item only* This display represents the set IPAP Max Setting as a percentage of the total cycle time as determined by the set BPM (backup) rate. Thus, the display indicates the maximum percentage inspiratory time should the patient breathe at the set BPM and have an inspiratory time equal to the set IPAP Max time. It does **not** represent the patient's measured percent inspiratory time.	This display is useful in ensuring that the set IPAP Max time is appropriate with respect to the total cycle time as determined by the set BPM (backup) rate. In the event that the IPAP Max time represents 50% or more of the total cycle time as determined by the set BPM rate, the following message will appear on the screen: "CAUTION I:E > 50%" This indicates that an actual inverse inspiratory ratio (ie, inspiratory time > expiratory time) may be achieved with the set IPAP Max and BPM settings.
Respiratory Rate (Secondary menu)	*Monitored Parameter* This is a display of the patient's respiratory rate based on the last two breaths detected by the VPAP II ST-A. In Spontaneous/Timed mode, the displayed respiratory rate will consist of both patient-initiated "spontaneous" and device-initiated "timed" breaths.	
Tidal Volume *(Secondary menu)*	*Monitored Parameter* This is a display of the calculated tidal volume delivered to the patient by the VPAP II ST-A. It is calculated on a breath-by-breath basis by integrating an estimate of patient flow, obtained by subtracting the leak flow and ResMed mask vent flow from the measured total flow rate.	This provides a useful indication of the trend and magnitude of change in the patient's tidal volume. Tidal volume will normally increase as IPAP pressure is increased. Since the VPAP II ST-A assumes the vent flow to be that of a ResMed mask when performing calculations, using masks other than ResMed masks will likely diminish accuracy in this display. Unintentional leak has a similar effect on these calculations. There will be some delay in the display of the Tidal Volume measurement after being selected.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
Leak *(Secondary menu)*	*Monitored Parameter* This is a display of leak as calculated by the VPAP II ST-A. It is a measure of additional airflow required to compensate for unintentional leak around the mask and/or through the patient's mouth. Since the VPAP II ST-A knows the expected vent flow of ResMed masks, it calculates any additional flow as leak. It is expressed in liters per minute (L/min) and updated continuously.	Ideally, leak rates should be kept below 25 L/min, to assure quality sleep[a]. Non-ResMed masks may yield erroneous leak calculations. Even then, the ResMed VPAP II ST-A will yield a useful indication of the trend and magnitude of change. There will be some delay in the display of the leak value after being selected. NOTE: The leak display provides an estimate and is for trending purposes only.
Pressure *(Secondary menu)*	*Monitored Parameter* This is a display of pressure delivered from the VPAP II ST-A. Delivered pressure is measured internally by a pressure transducer.	
IPAP Min *(Secondary menu)*	IPAP Min Time is a T_iCONTROL parameter. It allows adjustment of the minimum inspiratory time parameter ranging from 0.1secs to IPAP Max. IPAP Min Time is the minimum duration of time that the device will remain at the IPAP level.	The IPAP Min Time parameter allows the clinician to set a minimum time the patient spends in IPAP. The ability to set the minimum IPAP time is an important factor in optimizing patient/ ventilator synchronization for patients with restrictive diseases. For details on adjusting IPAP Min settings, see "TiCONTROL: IPAP Min and IPAP Max time Calculation Guide" on page 58.

a. Thomas J. Meyer, Mark R. Pressma, Joshua Benditt, Francis D. McCool, Richard P. Millman, Ranjini Natarajan, Nicholas S. Hill, Air Leaking Through the Mouth During Nocturnal Nasal Ventilation: Effect on Sleep Quality. *Sleep*1997; 20(7):561-569.

For other adjustable device settings and displayed items available in this mode, see "Additional Functions" on page 69. These include:

- SET START PRESSURE
- SMARTSTART/STOP
- MASK ALARM
- HUMIDIFIER
- OVERHEAT DEFAULT
- DELAY TIME

Timed Mode

This section discusses the key parameters that need to be adjusted, and the monitored items that are displayed in Timed mode.

The key adjustable parameters in this mode are:

- IPAP
- EPAP
- IPAP Max
- Rise Time
- BPM
- I:E ratio (this is a display-only item, but is dependent upon the IPAP Max and BPM settings)

The monitored parameters displayed in this mode are:

- Respiratory Rate
- Tidal Volume
- Leak
- Pressure

The key adjustable parameters and monitored parameters are discussed below in the order they appear in the VPAP II ST-A primary and secondary menus. For instructions on how to change settings see “VPAP II ST-A Set-up” on page 18.

For other adjustable device settings and displayed items available in this mode, see “Additional Functions” on page 69.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
MODE **“T”** *(Primary menu)*	In the Timed mode, the clinician sets the breathing rate and an inspiratory time. The inspiratory time is determined by the IPAP Max setting. The IPAP Min time parameter does not operate in the timed mode. In this mode, a "T" icon will briefly appear beneath the I:E value on the LCD screen to indicate the initiation of IPAP.	The Timed mode is used when a fixed inspiratory time and respiratory rate is desired, and the patient is not able to trigger the device consistently, or the basal respiratory rate is very low. It is important to note that the Timed mode is a "controlled" mode, not dependent on the breathing effort of the patient, should such effort exist.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
IPAP *(Primary menu)*	The IPAP (Inspiratory Positive Airway Pressure) setting ranges from 2 to 25 cm H_2O. This is the inspiratory pressure, which will be delivered to the patient when the device is triggered into inspiration. The difference between the IPAP and EPAP (IPAP-EPAP) determines the pressure support level delivered to the patient.	The setting of the inspiratory pressure is made on the basis of patient tolerance and the effect of the pressure on ventilation and gas exchange. As the IPAP pressure is increased and the difference between IPAP and EPAP widens, the tidal volume will normally be increased. The changes in IPAP and Tidal Volume can both be observed on the LCD screen. It should be noted however, that unnecessarily high inspiratory pressure can produce worsening leak from the mask and mouth, thereby reducing the effectiveness of ventilatory support. These leaks will most likely occur in patients with very stiff lungs or chest walls, or in patients with weak facial muscles.
EPAP *(Primary menu)*	The EPAP (Expiratory Positive Airway Pressure) setting ranges from 2 cm H_2O to the set IPAP level This is the amount of pressure in the circuit during the patient's expiratory phase.	EPAP is used to: • assist flushing of exhaled CO_2 through the mask vents during exhalation, • maintain patency of the upper airway, especially important during sleep, • overcome intrinsic PEEP in patients with obstructive lung disease, and • improve oxygenation and end expiratory lung volumes in patients with low lung volumes. For guidelines on adjusting EPAP settings, see "Set-up Flow Chart (S and S/T Mode)" on page 57.
IPAP Max *(Primary menu)*	In Timed mode, the IPAP Max Time represents the inspiratory time. That is, the amount of time the device spends in IPAP will always equal the set IPAP Max time.	This setting determines the inspiratory time for each breath. In Timed mode, the patient cannot vary their inspiratory time nor regulate their own I:E ratio.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
Rise Time *(Primary menu)*	Rise Time is the time taken for the pressure to increase from EPAP to IPAP*. The VPAP II ST-A allows the Rise Time to be set to MIN (the fastest or shortest Rise Time). It can also be set in 50 millisecond increments from 150 to 900. The higher the Rise Time setting, the longer it takes for the pressure to increase from EPAP to IPAP. *NOTE: The Rise Time scale approximates the time taken (in milliseconds) for the pressure to increase from 10% to 90% of the IPAP-EPAP pressure difference under controlled conditions. Range: 90 msec (nominal) to 900 msec	Generally, Rise Time is adjusted to achieve maximum patient comfort. The patient should feel that they are receiving adequate flow but not be startled by each transition to the IPAP level. Consideration of the IPAP Max time will also help guide where to set the Rise Time. Setting the Rise Time too long can limit the time spent at IPAP and could impair ventilation.
BPM *(Primary menu)*	This parameter sets the Breaths Per Minute (BPM). In Timed mode, this represents the fixed respiratory rate at which the device will deliver therapy. It determines the length of time between triggering events (ie. the respiratory "cycle" time). The BPM rate ranges from 5–30 breaths per minute.	Timed mode is a "controlled" mode, not dependent on the breathing effort of the patient, should such effort exist. The BPM rate should therefore be set at the rate the clinician wants the device to deliver therapy.
I:E Display *(Primary menu)*	*Display Item only* This display represents the set inspiratory time (as determined by the IPAP Max setting) as a percentage of the total cycle time (as determined by the set BPM rate).	In Timed mode, the displayed value represents the actual percentage of time the device will spend in IPAP for each respiratory cycle. It is useful in ensuring that the set inspiratory time (as determined by the IPAP Max setting) is appropriate with respect to the total cycle time (as determined by the set BPM rate). In the event that the IPAP Max time represents 50% or more of the total cycle time as determined by the set BPM rate, the following message will appear on the screen: "CAUTION I:E > 50%" This indicates that an actual inverse inspiratory ratio (ie. inspiratory time > expiratory time) may be achieved with the set IPAP Max and BPM settings.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
Respiratory Rate (Secondary menu)	*Monitored Parameter* This is a display of the respiratory rate based on the last two breaths detected by the VPAP II ST-A. In Timed mode, the displayed respiratory rate will consist of device-initiated "timed" breaths only as dictated by the set BPM rate.	
Tidal Volume *(Secondary menu)*	*Monitored Parameter* This is a display of the calculated tidal volume delivered to the patient by the VPAP II ST-A. It is calculated on a breath-by-breath basis by integrating an estimate of patient flow, obtained by subtracting the leak flow and ResMed mask vent flow from the measured total flow rate.	This provides a useful indication of the trend and magnitude of change in the patient's tidal volume. Tidal volume will normally increase as IPAP pressure is increased. Since the VPAP II ST-A assumes the vent flow to be that of a ResMed mask when performing calculations, using masks other than ResMed masks will likely diminish accuracy in this display. Unintentional leak has a similar effect on these calculations. There will be some delay in the display of the Tidal Volume measurement after it is selected.
Leak *(Secondary menu)*	*Monitored Parameter* This is a display of leak as calculated by the VPAP II ST-A. It is a measure of additional airflow required to compensate for unintentional leak around the mask and/or through the patient's mouth. Since the VPAP II ST-A knows the expected vent flow of ResMed masks, it calculates any additional flow as leak. It is expressed in liters per minute (L/min) and updated continuously.	Ideally, leak rates should be kept below 25 L/min, to assure quality sleep[a]. Non-ResMed masks may yield erroneous leak calculations. Even then, the ResMed VPAP II ST-A will yield a useful indication of the trend and magnitude of change. There will be some delay in the display of the leak value after being selected. NOTE: The leak display provides an estimate and is for trending purposes only.
Pressure *(Secondary menu)*	*Monitored Parameter* This is a display of pressure delivered from the VPAP II ST-A. Delivered pressure is measured internally by a pressure transducer.	

a. Thomas J. Meyer, Mark R. Pressma, Joshua Benditt, Francis D. McCool, Richard P. Millman, Ranjini Natarajan, Nicholas S. Hill, Air Leaking Through the Mouth During Nocturnal Nasal Ventilation: Effect on Sleep Quality. *Sleep*1997; 20(7):561-569.

For other adjustable device settings and displayed items available in this mode, see “Additional Functions” on page 69. These include:

- SET START PRESSURE
- SMARTSTART/STOP
- MASK ALARM
- HUMIDIFIER
- OVERHEAT DEFAULT
- DELAY TIME

CPAP MODE

This section discusses the key parameters that need to be adjusted, and the monitored items that are displayed in CPAP mode.

The key adjustable parameter that needs to be adjusted in this mode is IPAP, which represents the single, fixed pressure that the device will deliver.

The monitored parameters displayed in this mode are:

- Respiratory Rate
- Leak
- Pressure

The CPAP parameter and monitored parameters are discussed below in the order they appear in the VPAP II ST-A primary and secondary menus. For instructions on how to change settings see "VPAP II ST-A Set-up" on page 18.

For other adjustable device settings and displayed items available in this mode, see "Additional Functions" on page 69.

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
MODE **"CP"** *(Primary menu)*	In CPAP mode, a single, fixed pressure is delivered.	The CPAP mode is often used in OSA patients who require no tidal volume augmentation.
IPAP *(Primary menu)*	The IPAP (Inspiratory Positive Airway Pressure) setting ranges from 2 to 25 cm H_2O. This is the CPAP pressure the patient will receive.	Use this parameter to set the CPAP pressure.
Respiratory Rate *(Secondary menu)*	*Monitored Parameter* This is a display of the patient's respiratory rate based on the last two breaths detected by the VPAP II ST-A.	

ADJUSTABLE/ MONITORED PARAMETER	DESCRIPTION	USAGE
Leak *(Secondary menu)*	*Monitored Parameter* This is a display of leak as calculated by the VPAP II ST-A. It is a measure of additional airflow required to compensate for unintentional leak around the mask and/or through the patient's mouth. Since the VPAP II ST-A knows the expected vent flow of ResMed masks, it calculates any additional flow as leak. It is expressed in liters per minute (L/min) and updated continuously.	Ideally, leak rates should be kept below 25 L/min, to assure quality sleep[a]. Non-ResMed masks may yield erroneous leak calculations. Even then, the ResMed VPAP II ST-A will yield a useful indication of the trend and magnitude of change. There will be some delay in the display of the leak value after being selected. NOTE: The leak display provides an estimate and is for trending purposes only.
Pressure *(Secondary menu)*	*Monitored Parameter* This is a display of pressure delivered from the VPAP II ST-A. Delivered pressure is measured internally by a pressure transducer.	

a. Thomas J. Meyer, Mark R. Pressma, Joshua Benditt, Francis D. McCool, Richard P. Millman, Ranjini Natarajan, Nicholas S. Hill, Air Leaking Through the Mouth During Nocturnal Nasal Ventilation: Effect on Sleep Quality. *Sleep*1997; 20(7):561-569.

For other adjustable device settings and displayed items available in this mode, see "Additional Functions" on page 69. These include:

- SET START PRESSURE
- SMARTSTART/STOP
- MASK ALARM
- HUMIDIFIER
- DELAY TIME

STARTING TREATMENT

1

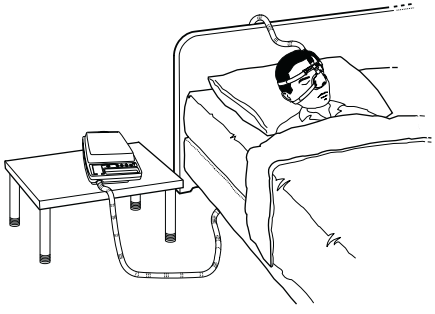
Assemble the VPAP II ST-A and connect the air tubing. See "Assembly" on page 15.

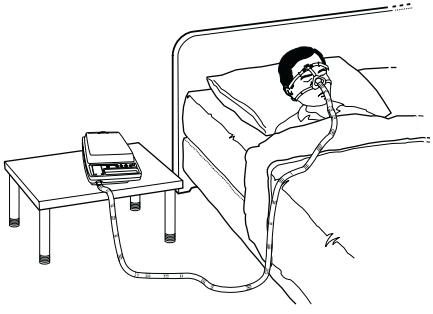
2

Assemble the mask system as described in the mask system user instructions, and fit it to the patient.

3

Arrange the air tube so that it allows the patient to move freely while asleep.





* this configuration not possible with Mirage mask

CAUTIONS

- Do not leave long lengths of air tubing around the top of the bed which could twist around the patient's head or neck while sleeping.
- Make sure the area around the VPAP II ST-A is clean (dust free) and clear of bedding, clothes, and any other potential air intake blockages.

4

Start the VPAP II ST-A in one of the following ways:

START/STOP

Press the **Start/Stop** button to start the air flow. The air will begin flowing slowly and build up to pressure in approximately 20 seconds.

OR

DELAY TIMER

If the Delay Timer function has been enabled, you can start the VPAP II ST-A by pressing one of the Delay Timer buttons. Note: the settings menu must be locked to use the Delay Timer.

See “Delay Timer” on page 80.

OR

SMARTSTART/ STOP

When SmartStart/Stop (simply referred to as SmartStart) is enabled, the VPAP II ST-A will automatically start when the patient breathes into the mask, and automatically stop when they remove it. Set this by selecting the SMARTSTART/STOP option in the Secondary menu, see “VPAP II ST-A Set-up” on page 18. The Delay Timer option is still available.

NOTE

If the Mask Alarm is enabled, SmartStart/Stop will not operate when the mask is removed.

5

To stop treatment, simply press the **Start/Stop** button. If SmartStart is enabled, the flow will stop automatically when the patient removes their mask.

Remember that the patient must remove their mask whenever the VPAP II ST-A is not operating.

NOTE

Some air circuit components (eg. masks, filters, tubing) may affect the operation of the SmartStart feature. In the event that SmartStart does not trigger the operation of the VPAP II ST-A, start or stop the device by pressing the **Start/Stop** *button. For further details see “Using SmartStart or the Mask Alarm with a humidifier or antibacterial filter” on page 64.*

Optimizing Settings For Effective Ventilation

Synchronization

The key to effective NPPV is synchronization—how effectively the ventilator keeps in step with, responds to and supports the patient's own breathing rhythm. Synchronization is achieved by the ventilator quickly and reliably detecting when the patient inhales and when the patient exhales and changing the pressure accordingly. In so doing, the ventilator is matching both the frequency and pattern of the patient's spontaneous breathing effort.

Synchronization is most often affected by:

- mask and mouth leaks
- the patient's disease state.

Mask and/or Mouth Leaks

Most bi-level devices measure the patient's flow rate to detect when to trigger to IPAP and when to cycle to EPAP. Mask and/or mouth leaks can interfere with this triggering and cycling. The magnitude of mask and/or mouth leaks will change, especially during the night as the patient sleeps. Poor synchronization between the patient and device will result if these leaks are not solved or compensated for. This poor synchronization forces patients to exhale against the higher IPAP level which increases work of breathing and can cause fragmented sleep, muscle fatigue and reduced compliance.

Counteracting the Effects of Mask and Mouth Leaks

The ResMed VPAP II ST-A system counteracts the effects of leak, thereby maximizing patient/ventilator synchronization with a three-layered approach:

1. ResMed Masks – minimizing leak
2. Vsync™ – automatic leak management
3. T_iCONTROL – inspiratory time control

ResMed masks

The selection of a good-fitting, easy-to-use, comfortable mask is the first step in ensuring good synchrony and effective ventilation. ResMed's Mirage® and Ultra Mirage masks provide comfort while minimizing leaks.

Studies show that almost all patients on bi-level therapy experience mouth leaks during sleep[1, 2]. The MIRAGE FULL FACE MASK solves mouth leaks by providing a comfortable seal around both the nose and mouth.

Vsync: AUTOMATIC LEAK MANAGEMENT – TRIGGER/CYCLE THRESHOLD ADJUSTMENT

Vsync is the automatic leak management algorithm unique to the VPAP II series.

Vsync continuously monitors changing leaks and estimates the patient respiratory flow. It continuously measures a patient's respiratory flow to enable it to make triggering and cycling decisions. A breath is triggered if this flow signal exceeds a flow threshold value above baseline (see Figure 8). A breath is cycled if this flow signal falls below a flow threshold value. The VPAP II ST-A continuously measures flow caused by leak. It automatically compensates for intentional and unintentional leak by adjusting the baseline flow. As the baseline is adjusted, the trigger and cycle thresholds (see Figure 8) are maintained. In this way the VPAP II ST-A assures patient/ventilator synchronization in the presence of changing leaks throughout sleep.

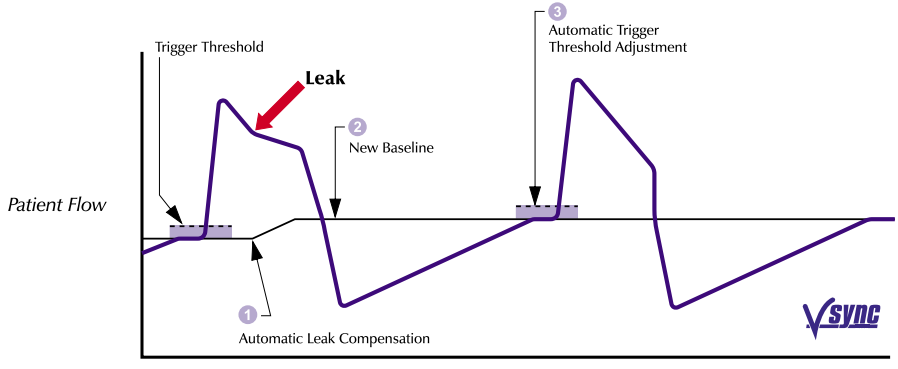


Figure 8: Vsync – Automatic Leak management

1. Thomas J. Meyer, Mark R. Pressma, Joshua Benditt, Francis D. McCool, Richard P. Millman, Ranjini Natarajan, Nicholas S. Hill, Air Leaking Through the Mouth During Nocturnal Nasal Ventilation: Effect on Sleep Quality. *Sleep*1997; 20(7):561-569.

2. H. Teschler, J Stampa, R. Ragette, N. Konietzko, M. Berthon-Jones, Effect of mouth leak on effectiveness of nasal bilevel ventilatory assistance and sleep architecture. *European Respiratory Journal* 1999:14; 1251-1257

T_iCONTROL: Inspiratory Time Control

Also unique to the VPAP II series and complementing Vsync, is the T_iCONTROL feature. This plays a significant role in assuring good patient/ventilator synchronization when there are leaks or changing disease conditions.

In the presence of large mouth and mask leaks, no bi-level system can accurately determine the patient's respiratory flow. As a consequence, during large mouth and mask leaks, most bi-level devices will continue to deliver their IPAP pressures while a patient is trying to exhale, leading to poor synchronization, increased work of breathing, poor ventilation, arousals from sleep, patient discomfort and non-compliance. Unless inspiratory time is controlled, patient-ventilator synchrony cannot be maintained.

The T_iCONTROL feature provides such control, enabling flexibility and synchronization even under large leak conditions.

T_iCONTROL allows the clinician to set minimum and maximum limits on the time that the device spends in IPAP. Called IPAP Min and IPAP Max time, these time limits are set at either side of the patient's ideal spontaneous inspiratory time. These provide a “window of opportunity” for the patient to spontaneously cycle to EPAP. Thus, the IPAP Min and IPAP Max times determine the Cycle Window.

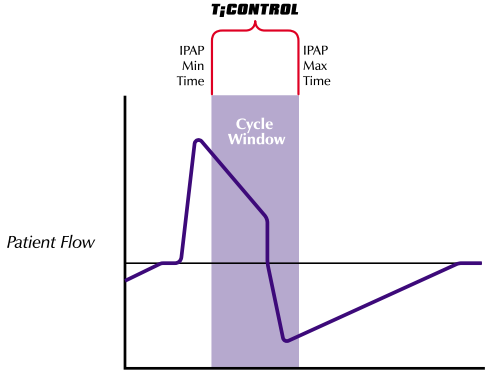


Figure 9: T_iCONTROL sets the Cycle Window

In the presence of large leaks, T_iCONTROL via the IPAP Max time parameter can effectively intervene to limit the IPAP duration. This ensures that the device remains in synchrony with the patient. Vsync with T_iCONTROL enable synchronization despite the presence of leaks, even large ones. Thus, the VPAP II ST-A provides security for both patient and clinician.

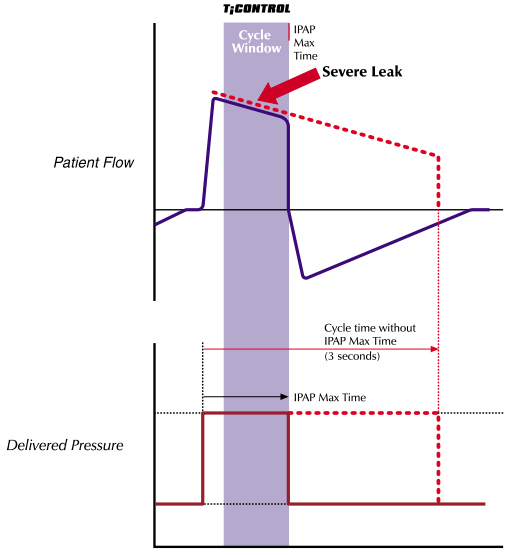


Figure 10: IPAP Max Time – Ensures cycling in the presence of leaks

T_iCONTROL: MANAGING DIFFERENT DISEASE STATES

T_iCONTROL also allows the clinician to set limits on the spontaneous inspiratory time for patients with particular disease states such as obstructive lung diseases and restrictive respiratory disorders.

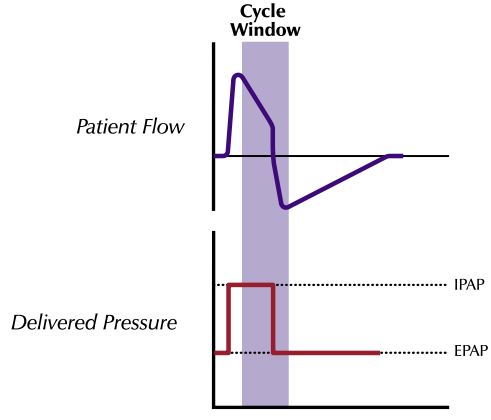


Figure 11: Normal – device cycles spontaneously within Cycle Window

MANAGING OBSTRUCTIVE LUNG DISEASES

Some patients with obstructive lung diseases may have a very slow decrease in inspiratory flow due to high airway resistance. This can lead to late cycling, with an associated prolonged inspiratory time and a shortened expiratory time. This in turn increases the risk of Intrinsic PEEP caused by further air trapped in the lungs. For these patients, the IPAP Max feature allows you to set a maximum time that the device will spend in IPAP, assuring sufficient expiratory times.

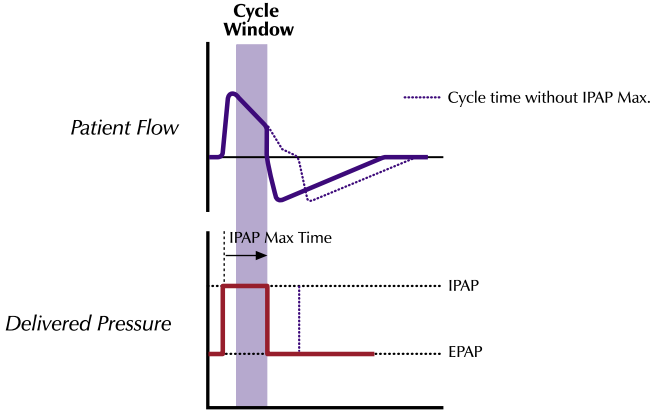


Figure 12: Obstructive (High Airway Resistance) – device cycles within Cycle Window at IPAP Max Time

MANAGING RESTRICTIVE DISORDERS

Some patients with restrictive disorders may cycle to expiration too early, especially during certain stages of sleep. This can lead to under-supported breaths, diminished tidal volumes and poor ventilation. For these patients, T_iCONTROL's IPAP Min feature allows you to set a minimum time that the machine will spend in IPAP before spontaneous cycling is allowed, thus increasing inspiratory time.

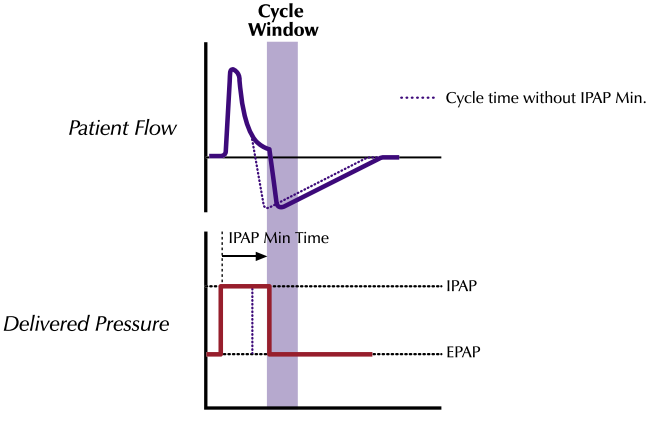


Figure 13: Restrictive – device cycles within Cycle Window at IPAP Min Time

SET-UP FOR DIFFERENT DISEASE STATES

RESTRICTIVE LUNG DISORDERS *(eg. chest-wall deformity, neuromuscular diseases)*

As mentioned above, some patients with restrictive respiratory disorders have problems with early or premature cycling to expiration. This will cause inspiratory time to be too short and could affect the patient's ability to have an adequate tidal volume, resulting in hypoventilation. A safety system, IPAP Min, is included in the VPAP II ST-A to prevent premature or early cycling.

Late cycling is not a common problem in this patient population, however high leak conditions can interfere with cycling to expiration and eventually cause poor patient/ventilator synchrony. A safety system, IPAP Max, is included in the VPAP II ST-A to prevent late cycling.

SETTING T_iCONTROL'S IPAP MIN TIME

1. Measure the respiratory rate during ventilation and at rest (see "Measuring Respiratory Rate" on page 59).
2. Refer to the column entitled Restrictive IPAP Min in "TiCONTROL: IPAP Min and IPAP Max time Calculation Guide" on page 58.
3. Set IPAP Min to the value that corresponds to the resting respiratory rate from step 1.
4. If the patient complains that inspiratory time is too long or too short, verify the respiratory rate and IPAP Min setting

   or

   adjust the IPAP Min setting until the patient feels the inspiratory time is slightly too long.
5. Reduce the IPAP Min setting by 0.2 to 0.3 second from the setting in the previous step.

SETTING T_iCONTROL'S IPAP MAX TIME

1. Measure the respiratory rate during ventilation and at rest (see "Measuring Respiratory Rate" on page 59).
2. Refer to the column entitled Restrictive IPAP Max in "TiCONTROL: IPAP Min and IPAP Max time Calculation Guide" on page 58.
3. Set IPAP Max to the value that corresponds to the resting respiratory rate from step 1.
4. If the patient complains that inspiratory time is too short, verify the respiratory rate and IPAP Max setting.

OBSTRUCTIVE PULMONARY DISEASE *(eg. COPD, asthma-acute exacerbation)*

Patients with chronic obstructive pulmonary disease typically require a longer expiratory time to avoid or minimize air-trapping. Failure to cycle to expiration can occur due to high airway resistance and/or a high leak condition. This could increase inspiratory time and cause further air-trapping, interfere with cycling and eventually cause poor patient/ventilator synchrony. A safety system, IPAP Max, is included in the VPAP II ST-A to prevent late cycling.

SETTING T_iCONTROL'S IPAP MAX TIME

1. Measure the respiratory rate during ventilation and at rest (see "Measuring Respiratory Rate" on page 59).
2. Refer to the column entitled COPD IPAP Max in "TiCONTROL: IPAP Min and IPAP Max time Calculation Guide" on page 58.
3. Set IPAP Max to the value that corresponds to the resting respiratory rate from step 1.
4. If the patient complains that the inspiratory time is too short, verify the respiratory rate and IPAP Max setting.

SETTING T_iCONTROL'S IPAP MIN TIME

Most patients with obstructive pulmonary disease do not have problems with premature cycling, therefore the IPAP Min setting can remain at the default setting of 0.1 second.

NORMAL PULMONARY SYSTEM *(eg. normal lungs, using nasal mask)*

Nasal mask therapy is often associated with mouth leaks that can lead to prolonged inspiratory time due to late cycling. This can cause patient/ventilator dysynchrony, sleep disruption, non-compliance, and other complications. A safety system, IPAP Max, has been added to the VPAP II ST-A to prevent late cycling.

NOTE

Humidification can decrease patient airway resistance and help with small mouth leaks. See "Humidification" on page 61. Large mouth leaks should be managed by using a Mirage Full Face Mask. See "ResMed masks" on page 49.

SETTING IPAP MAX TIME

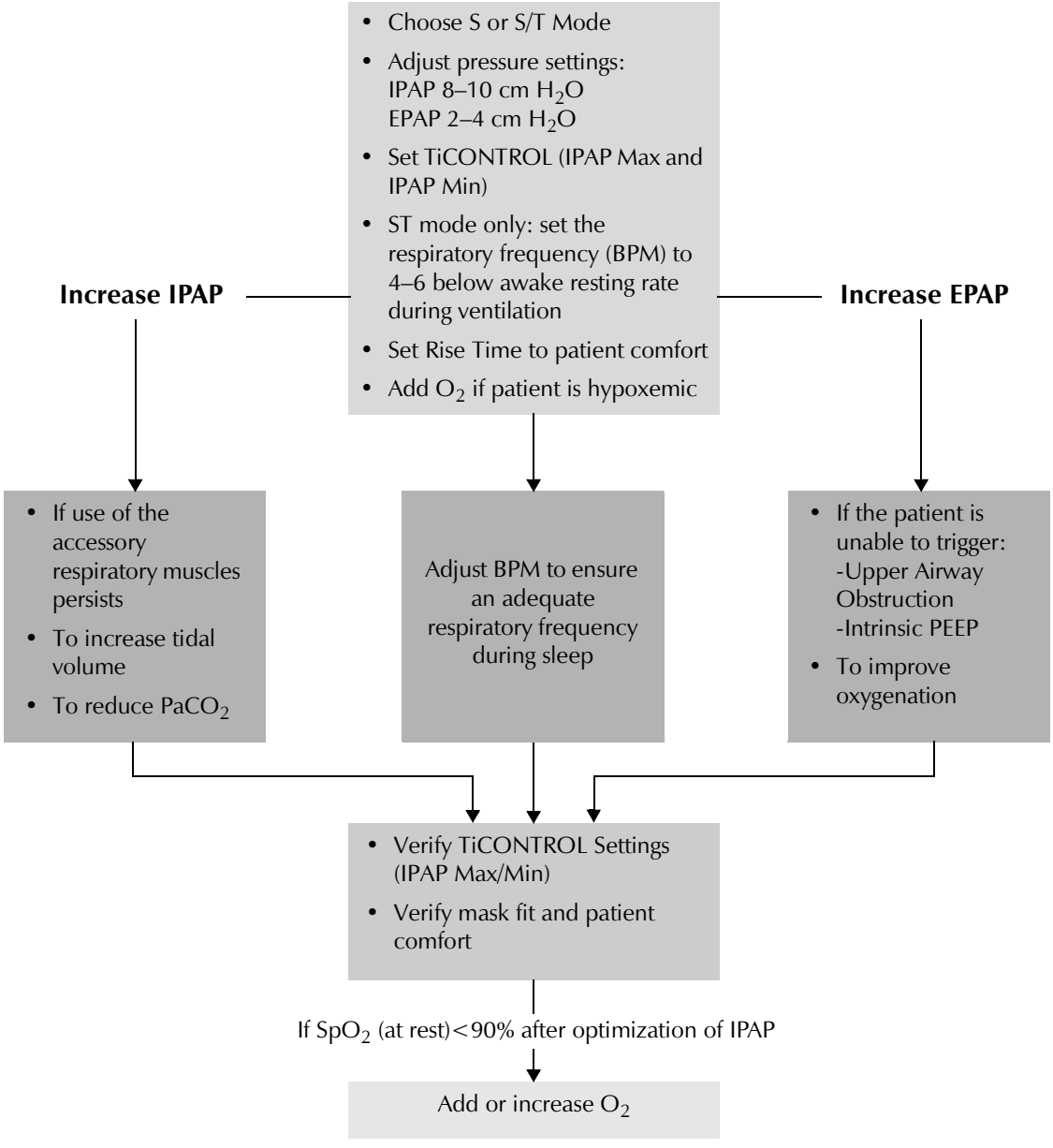
1. Measure the respiratory rate during ventilation and at rest (see "Measuring Respiratory Rate" on page 59).
2. Refer to the column entitled Normal IPAP Max in "TiCONTROL: IPAP Min and IPAP Max time Calculation Guide" on page 58.
3. Set IPAP Max to the value that corresponds to the resting respiratory rate from step 1.

4. If the patient complains that the inspiratory time is too short, verify the respiratory rate and IPAP Max setting.

Setting IPAP Min time

Most patients with a normal pulmonary system do not have problems with premature cycling, therefore the IPAP Min setting can remain at the default setting of 0.1 second.

Set-up Flow Chart (S and S/T Mode)



T_iCONTROL: IPAP MIN AND IPAP MAX TIME CALCULATION GUIDE

To adjust IPAP Min and IPAP Max (IPAP Min = Ti Min; IPAP Max = Ti Max), select the setting that corresponds to the patient's respiratory rate while using the ventilator at rest. For COPD and Normal Patients, IPAP Min setting can remain at the default setting of 0.1 second.

Respiratory Frequency (BPM)	Restrictive		COPD IPAP Max	Normal IPAP Max
	IPAP Max	IPAP Min		
30	1.0	0.5	0.7	1.0
29	1.0	0.5	0.7	1.0
28	1.1	0.5	0.7	1.1
27	1.1	0.6	0.7	1.1
26	1.2	0.6	0.8	1.2
25	1.2	0.6	0.8	1.2
24	1.3	0.6	0.8	1.3
23	1.3	0.7	0.9	1.3
22	1.4	0.7	0.9	1.4
21	1.4	0.7	0.9	1.4
20	1.5	0.8	1.0	1.5
19	1.6	0.8	1.0	1.6
18	1.7	0.8	1.1	1.7
17	1.8	0.9	1.2	1.8
16	1.9	0.9	1.2	1.9
15	2.0	1.0	1.3	2.0
14	2.1	1.1	1.4	2.1
13	2.3	1.2	1.5	2.3
12	2.5	1.3	1.7	2.5

MEASURING RESPIRATORY RATE

NOTE

Respiratory rate should be calculated with the patient ventilated and at rest when possible.

Measure the patient's resting respiratory rate during assisted ventilation. If you think the patient's respiratory rate will decrease during sleep and you are unable to measure it, then estimate the nocturnal respiratory rate and use this figure to determine the IPAP Max and IPAP Min setting. Refer to the section above that most appropriately matches the patient's condition. In some instances, recommended settings may need to be fine-tuned based on patient feedback and/or ongoing clinical assessment.

ADDING SUPPLEMENTAL OXYGEN

Up to 15 L/min of oxygen can be added at the mask or at an oxygen connector between the VPAP II ST-A and the air tubing.

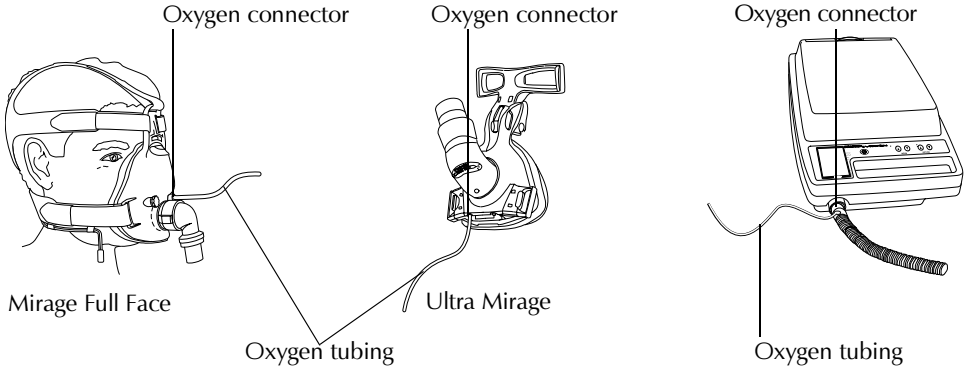


Figure 14: Adding supplemental oxygen at the mask and near the device

Adding oxygen at the air tubing near the VPAP II ST-A maintains mask pressure accuracy, whereas adding oxygen directly at the mask may increase mask pressure up to 2 cm H_2O above the prescribed level. There is less likelihood of the oxygen line becoming kinked or the connector breaking off the mask port if oxygen is added at the connector near the device. This method also improves the mixing of oxygen and air flow.

Actual oxygen concentrations will vary depending on the mask used, where the oxygen is introduced, pressure setting, volume delivered, leak, and patient breathing pattern.

WARNINGS

- Supplemental oxygen may desensitize the triggering of the VPAP II ST-A, more so at higher flow rates. Oxygen flow rates exceeding the mask's (EPAP) vent flow may contribute to oxygen flow back into the VPAP II ST-A.
- If oxygen is used with this device, the oxygen flow must be turned off when the device is not operating.

  Explanation: When the device is not in operation, and the oxygen flow is left on, oxygen delivered into the ventilator tubing may accumulate within the device enclosure and create a risk of fire.
- Always begin VPAP II ST-A therapy before the oxygen supply is turned on.
- Always turn the oxygen supply off before stopping VPAP II ST-A therapy.
- Oxygen supports combustion. Oxygen should not be used while smoking or in the presence of an open flame.

PROCEDURE

1. Fit the supplied oxygen connector to the air outlet of the VPAP II ST-A and fit the air tubing to the oxygen connector. Fit the oxygen supply tubing to the port on the oxygen connector.

   OR

   Fit the oxygen supply tubing directly to the mask port. A luer or nipple adapter may be required depending on the mask.
2. Attach the other end of the oxygen supply tubing to an oxygen flow meter.
3. Turn the VPAP II ST-A on.
4. (a) In acute patients with hypoxemia, first add oxygen to help reduce the work of breathing then optimize ventilator settings to improve ventilation.

   (b) In chronic patients who do not have an important hypoxemic component optimize ventilator settings to improve ventilation before adding oxygen so as not to mask poor ventilation with good SpO_2 levels.
5. Titrate oxygen according to your institutional guidelines or the physician's prescription.
6. If the patient is using oxygen at home, complete titration with the oxygen entrained into the circuit at the same place that the patient will be using at home.

HUMIDIFICATION

Humidification may be required for patients who experience nasal and upper airway drying as a consequence of the high flow dry air being directed through the nasal and oral passages. It may also be required for those individuals who have tenacious secretions.

INDICATIONS FOR HUMIDIFICATION

- nasal stuffiness/congestion
- rhinnorhea following the use of mask ventilation
- mouth dryness
- ventilation through a tracheostomy
- patients with thick secretions (eg. cystic fibrosis, bronchiectasis)

Richards and colleagues[1] demonstrated that leaks occurring during the use of non-invasive positive pressure ventilation could significantly increase nasal resistance. This increase in nasal resistance associated with leaks during positive pressure use can be largely prevented by fully humidifying the inspired air.

The VPAP II ST-A is fully compatible with ResMed humidifiers. ResMed produces passive and heated humidifiers that will humidify the air flow to relieve these symptoms. Contact your supplier for details.

SET-UP FOR USE WITH HUMIDAIRE HUMIDIFIER

Short (52cm) air tubing is a necessary accessory for connecting the VPAP II ST-A device to a HUMIDAIRE humidifier.

NOTE

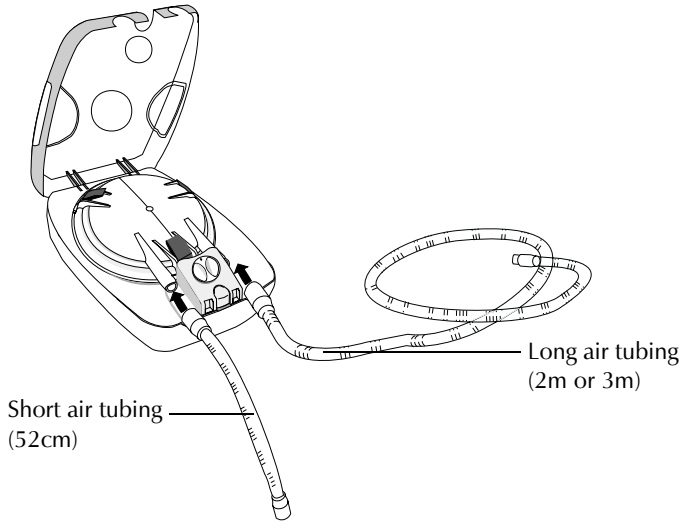
If a humidifier is used the HUMIDIFIER menu option must be set to ON, otherwise SmartStart and Mask Alarm operation may be affected. See "Using SmartStart or the Mask Alarm with a humidifier or antibacterial filter" on page 64.

1 Fill the humidifier with water according to the humidifier instruction manual.

1. Richards GN, Cistulli PA, Ungar RG, Berthon-Jones M, Sullivan CE, Mouth leak with nasal continuous positive airway pressure increases nasal airway resistance. *Am J Respir Crit Care Med* 1996; 154(1):182-186.

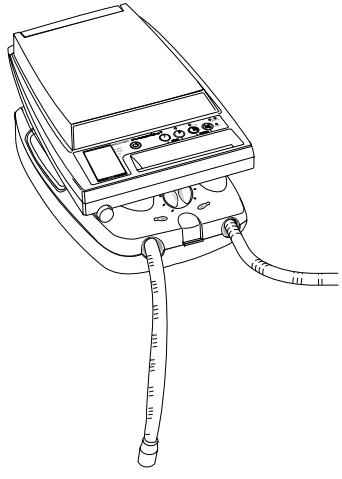
2

Place the filled water chamber inside the HUMIDAIRE. Connect the short air tubing (52cm) to the left connector port, and the long air tubing (2m or 3m) to the right connector port on the humidifier. Close the HUMIDAIRE lid.

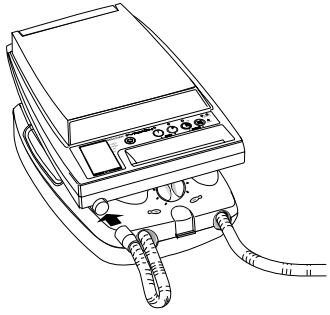


3

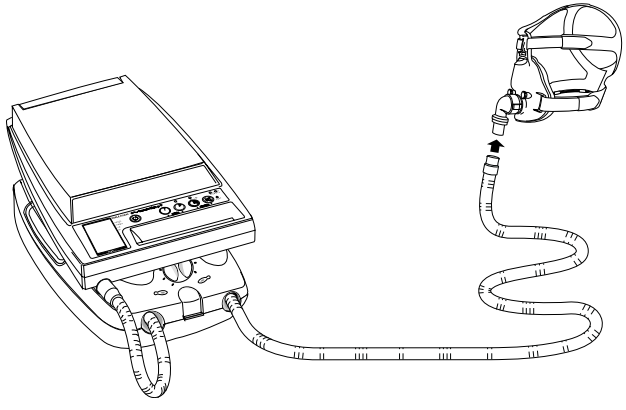
Place the VPAP II ST-A on top of the HUMIDAIRE. Do not place the VPAP II ST-A underneath the humidifier. This is to avoid water spilling into the VPAP II ST-A device.



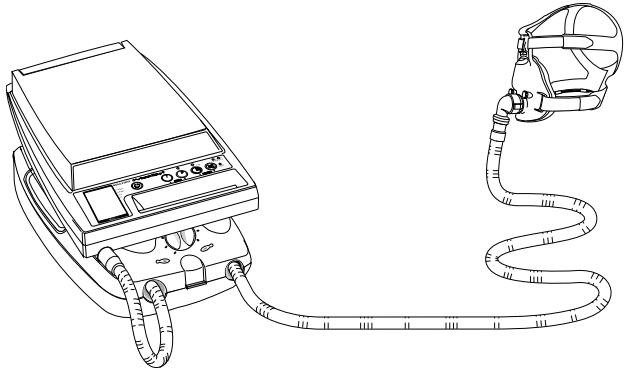
4 Connect the free end of the short air tubing to the air outlet of the VPAP II ST-A.



5 Connect the mask system to the free end of the long air tubing.



6 The final assembly should look like this:



7 Plug the HUMIDAIRE power cord into a power outlet and turn the power on.

---

8 Insert the VPAP II ST-A power cord into the socket at the rear of the device. Plug the other end of the power cord into a power outlet and turn the power on.

WARNING  Make sure that the power cord and plug are in good condition and the equipment is not damaged.

---

9 Navigate the VPAP II ST-A menu and set the HUMIDIFIER option to ON. See "VPAP II ST-A Set-up" on page 18.

The VPAP II ST-A is now ready for use with the HUMIDAIRE.

USING SMARTSTART OR THE MASK ALARM WITH A HUMIDIFIER OR ANTIBACTERIAL FILTER

You must activate the humidifier option in the HUMIDIFIER menu if the patient is using a humidifier. This is especially important if SmartStart or the Mask Alarm is enabled. Enabling the humidifier option adjusts the triggering threshold of these functions to ensure that VPAP II ST-A allows for the increased resistance of the humidifier.

Similarly, use of antibacterial filters may also require the humidifier option to be enabled to optimize the operation of SmartStart or the Mask Alarm. To test the Mask Alarm, see "Mask Alarm Test (daily)" on page 77.

Using a ResControl

The ResControl can be used to simultaneously monitor respiratory parameters while adjusting parameters and/or remotely adjust the VPAP II ST-A. When a setting on the ResControl is changed, the display on the VPAP II ST-A will automatically update. Similarly, when a setting on the VPAP II ST-A is changed, the ResControl will automatically update its display.

For full details, please refer to the *ResControl Clinician's Manual*.

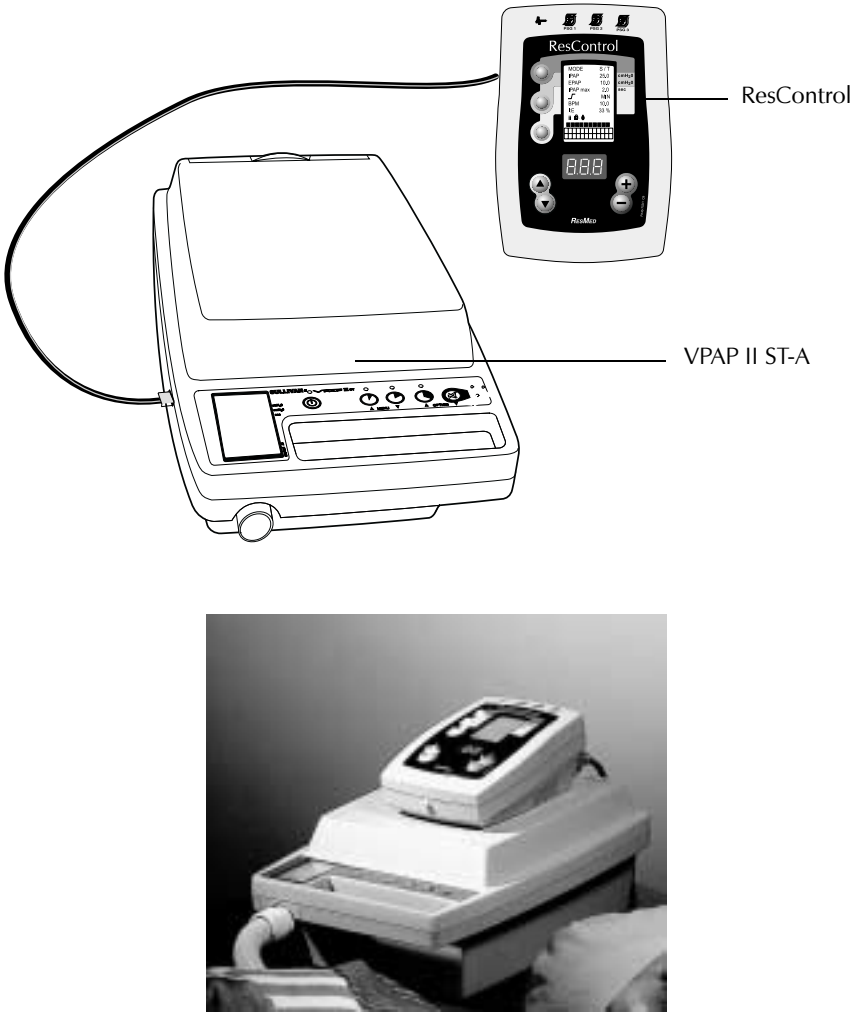


Figure 15: Connecting ResControl to the VPAP II ST-A

Clinical Troubleshooting

Common problems associated with non-invasive positive pressure support ventilation (NPPV)

Problem	Possible Solution
Patient acceptance of therapy	• Patient and family education • Gradual acclimatization • Many patients using NPPV have mouth leaks during sleep. This can cause poor synchronization and sleep fragmentation. Asking questions about mouth nose dryness, adding humidification and exploring the need for a Mirage Full Face Mask can improve the effectiveness of ventilation and improve patient acceptance. • Check ventilator settings (Rise Time, IPAP Min and Max)
Mask intolerance	• Intensive coaching and practice with the mask • Ensure patient has patent nasal passages • Review mask cushion size and fit • Assure patient is not over-tightening headgear
Mask leaks / eye irritation	• Adjust mask, forehead adjustment, or change mask cushion size
Mouth leaks / persistent hypoventilation	• Add humidification to reduce nasal resistance and change to a full face mask • Mirage Full Face Mask (available from ResMed. Contact your supplier for more details).
Nasal blockage/mucosal dryness	• Minimize mouth leaks • Add humidification • Use of topical nasal decongestants
Skin breakdown	• Wound dressing on nasal bridge • Change to Mirage or Bubble mask (available from ResMed. Contact your supplier for more details). • Ensure head-straps are not overtightened • Use of nasal pillows (this type of mask has a higher resistance, so ventilator settings should be checked)
Gastric distension	• Reduce peak inspiratory pressures • Modify Rise Time • Check ventilation mode. Spontaneous or S/T would be least likely to cause this.

(continued over page)

Problem	Possible Solution
(continued from previous page)	• Try gastrointestinal antispasmodics • Change sleeping position: lying on left side • Add humidification to reduce nasal resistance
Continued daytime sleepiness / sleep fragmentation	• Attend to mouth leaks • Refit mask to minimize mask leaks • Eliminate upper airway obstruction • Reduce peak inspiratory pressure • Add humidification to reduce nasal resistance
Upper airway obstruction	• Increase EPAP • Check if the problem is positional • Ensure the patient is not over-ventilated, causing glottic closure
Inability to trigger	• Check for mouth breathing and if so, change to Mirage Full Face Mask • Check for upper airway obstruction or intrinsic PEEP and increase EPAP accordingly (see "TiCONTROL: IPAP Min and IPAP Max time Calculation Guide" on page 58)
Intrinsic PEEP	• Slowly increase EPAP to reduce the work of breathing • Ensure IPAP Max is set appropriately (see "TiCONTROL: IPAP Min and IPAP Max time Calculation Guide" on page 58)

FOLLOW-UP

Where patients are using ventilatory support on a long term basis, regular follow-up is important.

The purpose of follow-up is to ensure that ventilation requirements have not altered over time, to determine the need for ongoing oxygen therapy and to change to an alternative form of ventilatory support if this is required.

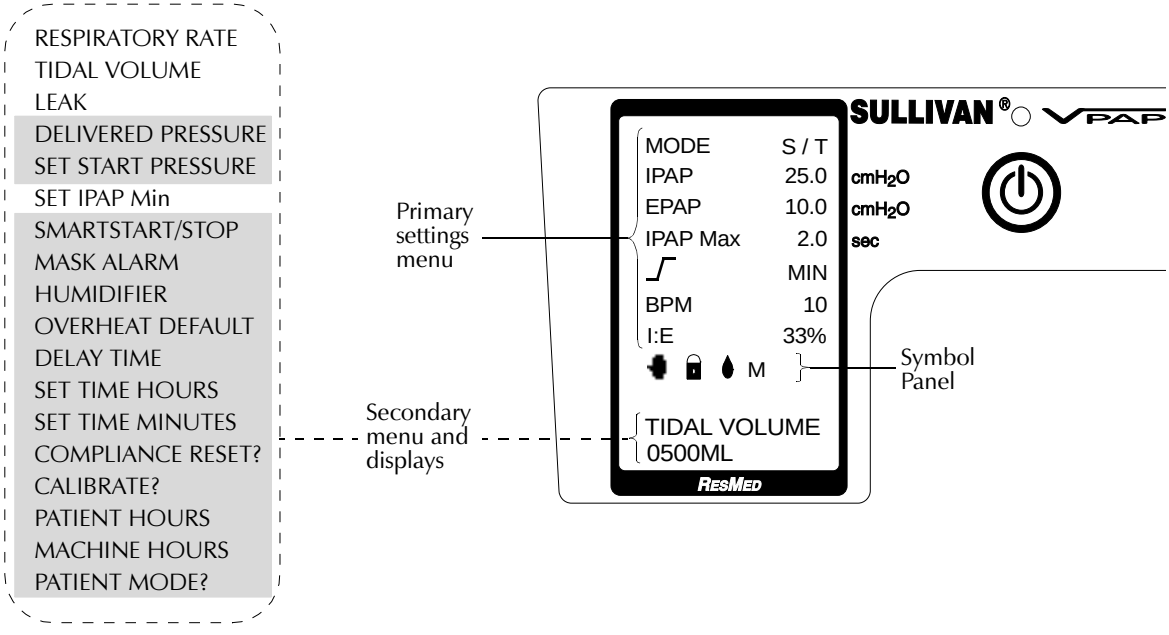
The frequency of follow-up will depend upon the stability of the patient's condition, and the problems which arise during therapy. Some clinicians have recommended that initial follow-up occur within the first three months of commencing nocturnal ventilatory assistance[1]. Subsequent follow-up will be dictated by patient need and unit policy.

1. Claman DM, Piper A, Sanders MH, Stiller RA, Votteri BA. Nocturnal non-invasive positive pressure ventilatory assistance. *Chest* 1996; 110(6): 1581-88.

ADDITIONAL FUNCTIONS

This section provides details on functions not previously covered in "Ventilator parameter settings for selected mode" on page 26. The functions described are those shaded in the diagram below.

OVERVIEW OF VPAP II ST-A PRIMARY AND SECONDARY MENUS



MONITORED PARAMETERS

DELIVERED PRESSURE

Delivered pressure is measured internally by a pressure transducer. The pressure transducer provides real-time measurement of circuit pressure. This transducer is used to provide a feedback loop to the microprocessor to assure accurate pressure delivery as well as pressure Rise Time control.

ADJUSTABLE SETTINGS

SET START PRESSURE

This parameter represents the pressure delivered by the VPAP II ST-A at the start of treatment during Delay Timer mode.

SmartStart/ Stop

When SmartStart/Stop (simply referred to as SmartSmart) is enabled, the VPAP II ST-A will automatically start when the patient breathes into the mask, and automatically stop when they remove it. The Delay Timer option is still available. Set this by selecting the SMARTSTART/STOP option in the Secondary menu (see "VPAP II ST-A Set-up" on page 18).

NOTE

If the Mask Alarm is enabled, SmartStart/Stop will not operate when the mask is removed.

Mask Alarm

The VPAP II ST-A is equipped with an optional Mask Alarm. When the alarm is enabled the VPAP II ST-A will illuminate an indicator light on the front panel, sound an alarm and display the "MASK OFF" message on the LCD screen if it detects an excessive air leak, for example if the patient's mask falls off during the night.

For full details, see "Mask Alarm" on page 75.

Humidifier

If a humidifier is being used, select "ON" in the Humidifier menu. In order for the SmartStart/Stop and Mask Alarm features to function correctly, the VPAP II ST-A must make adjustments for the added resistance of a humidifier. When Humidifier is selected, the icon will appear in the lower LCD area. This feature may also be used to adjust for added resistance of an antibacterial filter.

Overheat default

See "Overheating" on page 92.

Delay Timer

See "Delay Timer" on page 80.

Set time hours

Allows you to set the internal clock hours for compliance measurement purposes. A 24 hour display format is used, ie. 6 pm is 18:00.

SET TIME MINUTES

Allows you to set the internal clock minutes for compliance measurement purposes.

COMPLIANCE RESET?

To zero the patient hour counter and erase the saved compliance data, select the COMPLIANCE RESET? menu. It will ask ARE YOU SURE? If you select YES, then the compliance data will be erased and the counter reset. See "Downloading Compliance Data" on page 80.

To display total hours of patient use, see "Patient Hours" on page 71.

CALIBRATE?

If pressure calibration becomes necessary, see "Pressure Calibration" on page 89.

PATIENT HOURS

In patient mode, the VPAP II ST-A will display the total patient use hours if you press the **Alarm Cancel (OPTION ▼)** button.

Patient Hours displays the accumulated number of hours when the patient was receiving therapeutic treatment. It will only count hours when the device is operating and delivering pressure to the mask. If the Delay Timer is activated the recording of patient hours will not start until the ramp period is completed. Patient Hours is reset to zero when the Compliance Reset YES menu is selected.

MACHINE HOURS

Machine Hours records the accumulated number of operating hours. The user cannot reset it.

PATIENT MODE?

Locks the menus for patient use. See "Step 3" on page 19.

CHANGING THE LCD SCREEN LANGUAGE

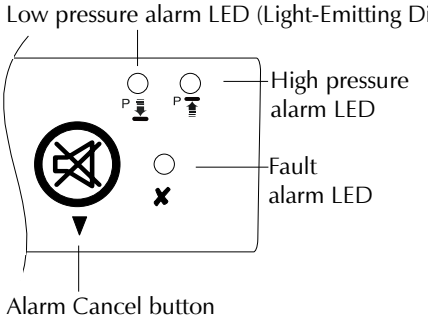
The LCD screen will operate in six languages: English, French, German, Spanish, Italian and Swedish. The default setting is English.

To change the language, hold down both the **MENU** buttons and turn the VPAP II ST-A on at the main power switch. The current language will be displayed. Use the ▲ **OPTION** ▼ buttons to select the desired language, and press the **Start/Stop** button to lock it in.

ALARMS AND WARNING LIGHTS

DEVICE ALARMS

The VPAP II ST-A device is equipped with an audible alarm and three warning lights to indicate when treatment is not being delivered correctly.



If the VPAP II ST-A detects an error it will illuminate one of the warning lights and sound the alarm. It may also display a message on the LCD (liquid crystal display) screen.

If the alarm sounds or one of the warning lights illuminate, silence the audible alarm by pressing the **Alarm Cancel** button and follow the actions outlined in the table below.

Warning signal	Cause	Action
Low pressure light, "MASK OFF" message on LCD screen, and buzzer *See "Mask Alarm" on page 75 for more information*	• Mask has become dislodged from your patient's face and a high leak is occurring	• Reposition the mask on your patient's face
	• Air tubing disconnected	• Reconnect air tubing
Low pressure light and buzzer	• Air tubing disconnected	• Reconnect air tubing
	• Hardware error	• Return your VPAP II ST-A for servicing • DO NOT USE THE VPAP II ST-A DEVICE
High pressure light and buzzer	• Hardware error	• Return your VPAP II ST-A for servicing • DO NOT USE THE VPAP II ST-A DEVICE

Warning signal	Cause	Action
Fault light and buzzer	• Accidental disconnection from mains power	• Check both ends of the power cord are firmly connected, and the main power switch is on
	• Mains power failure	• Remove the patient's mask but leave the VPAP II ST-A on; operation will resume when power is restored
"O'HEAT ALARM" message on LCD screen and buzzer *See "Overheating" on page 92 for more information*	• Rapid breathing and high ambient room temperature have caused the motor to overheat	• If the patient is comfortable with the constant pressure, let it run; the motor will cool down after about 15 minutes and resume normal operation • If the single pressure is uncomfortable, stop the unit by pressing the **Start/Stop** button and allow it to cool; you may resume normal operation when cool • Cool the room if possible, but do not direct the source of cold dry air toward the VPAP II ST-A
	• Air inlet filters clogged	• Replace inlet filters (see "Replacing the air filter strip" on page 92)

Alarm Cancel Button

The alarm will sound for a minimum of one minute in the event of a power fault, and as long as the alarm condition exists for other alarms.

You can press the **Alarm Cancel** button to silence the alarm at any time. If the alarm was caused by a high mask leak, correcting the cause of the leak will also silence the alarm. If the alarm was caused by a high pressure condition, the high pressure light will continue to flash until the VPAP II ST-A is turned off. If you only press the **Alarm Cancel** button and do not remove or fix the cause of the alarm, the alarm will trigger again after two minutes.

MASK ALARM

The VPAP II ST-A is equipped with an optional Mask Alarm. When the alarm is enabled the VPAP II ST-A will illuminate the low pressure alarm indicator light on the front panel, sound an alarm and display the "MASK OFF" message on the LCD screen if it detects an excessive air leak, for example if the patient's mask falls off during the night.

Pressing the **Alarm Cancel** button will silence the audible alarm and erase the message on the LCD, but the indicator light will remain lit until you correct the cause of the alarm. The audible alarm will not retrigger while the original alarm condition persists. When the alarm condition is resolved, the visual and audible alarms are reset.

NOTE

If the Mask Alarm is enabled, SmartStart/Stop will not operate when the mask is removed.

The factory default setting for the VPAP II ST-A is alarm enabled. If desired, use the MASK ALARM menu option to disable the alarm. To do this, see "VPAP II ST-A Set-up" on page 18.

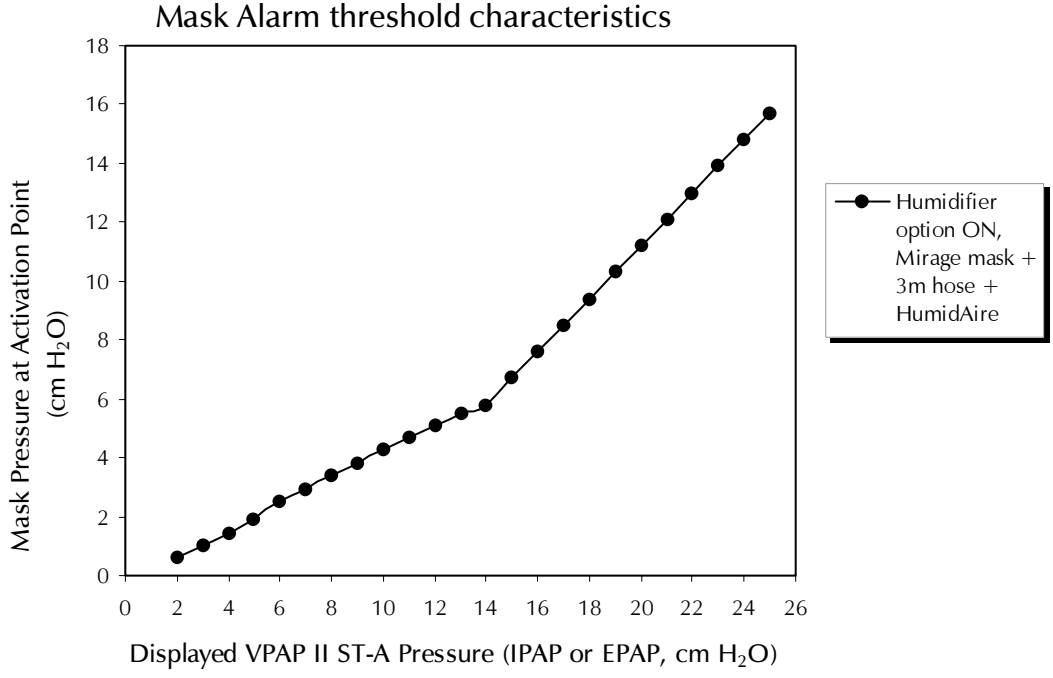
WARNING

Mask Alarm activation is a function of the VPAP II ST-A's set pressure, the air delivery system in use and whether the humidifier mode is set. Certain set pressures and combinations of air delivery components may cause failure of the Mask Alarm to activate. ResMed recommends that the Mask Alarm is tested before commencing treatment. See "Testing the Alarms" on page 77.

MASK ALARM ACTIVATION PRESSURES

The mask alarm activates when flow exceeds a flow threshold contour. Because the alarm is flow-activated, the corresponding mask pressure will depend on the impedance of the air circuit in use.

The example shown in the following graph approximates the mask pressure at which the alarm is activated for a relatively high-impedance air circuit, with the Humidifier option ON. For lower impedance air circuits (eg. Humidifier option OFF, ULTRA MIRAGE MASK, 2m hose, no humidifier), the alarm will typically be activated at higher mask pressures. The following graph is provided as a guide only.



TESTING THE ALARMS

It is recommended that you test the Mask Alarm every day before use and each time any component of the breathing circuit is altered, the buzzer, LEDs (Light-Emitting Diodes) and the power failure each week, and low pressure alarms once a month. The high pressure alarm is factory tested using specialized test equipment.

WARNING

You can mute the alarm at any time by pressing the **Alarm Cancel** button.

MASK ALARM TEST (DAILY)

1. Configure the VPAP II ST-A as it will be used by the patient (see "Assembly" on page 15 and "VPAP II ST-A Set-up" on page 18).
2. Block the opening of the mask and press the **Start/Stop** button.
3. Allow the VPAP II ST-A to run for 5 seconds or until the pressure stabilizes. Then unblock the opening of the mask.
4. The Mask Alarm should activate within 5 to 10 seconds. If the Mask Alarm fails to activate, reconfigure the system or refer to the Mask Alarm reference in the Troubleshooting section on page 95.

BUZZER/LED TEST (WEEKLY)

1. Hold down the **Alarm Cancel** button and turn the VPAP II ST-A on at the main power switch. If the VPAP II ST-A is already on, you will need to turn it off first.
2. Keep the **Alarm Cancel** button pressed until the buzzer and LEDs activate. The buzzer will sound and the LEDs will flash for approximately ten seconds.

POWER FAILURE ALARM TEST (WEEKLY)

1. With the air tubing and mask connected, turn the VPAP II ST-A on and press the **Start/Stop** button. Let it run for at least eight seconds to allow the backup capacitors to fully charge.
2. Turn the VPAP II ST-A off using the main power switch. The buzzer and fault LED will activate for approximately one minute.

LOW PRESSURE ALARM TEST (MONTHLY)

1. Disconnect the air tubing from the VPAP II ST-A.
2. Turn the VPAP II ST-A on and press the **Start/Stop** button. After a few seconds, the buzzer will sound and the low pressure LED will light up

WARNING

If the buzzer/LED, power failure alarm or low pressure alarm tests do not work, carefully repeat the steps above. If they still do not work, return the VPAP II ST-A to your supplier for servicing. Do not attempt to service the unit yourself.

SET-UP FOR HOME TREATMENT

When you set up a VPAP II ST-A for a patient to take home, there are a number of things to be aware of.

1. Always set pressures and oxygen levels with the equipment set up in exactly the same way as it will be used at the patient's home (eg. with the humidifier connected, the oxygen line entrained at the same place, same length air tubing and same mask system).
2. Ensure that the patient has the relevant user's manual(s), and understands how to operate the equipment.
3. When changing the settings, consider whether the patient would like some of the options enabled (if the prescribing physician permits it) such as:
   - SmartStart
   - Mask Alarm
   - Humidifier (if using a humidifier and SmartStart or Mask Alarm, see "Using SmartStart or the Mask Alarm with a humidifier or antibacterial filter" on page 64)
   - Delay Timer limits
   - Lower Start Pressure
4. The LCD screen backlighting will automatically turn off when the setting menus are locked.
5. Always remember to lock the setting menus using the PATIENT MODE menu. See "Step 3" on page 19. This is to prevent the patient from adjusting their prescribed settings.

Make sure that the patient has a contact phone number in case of emergency. A good place to write this is in the front of the user's manual.

RESETTING THE VPAP II ST-A

RESETTING COMPLIANCE

To zero the patient hour counter and erase the saved compliance data, select the COMPLIANCE RESET? menu. It will display ARE YOU SURE? If you select YES, then the compliance data will be erased and the counter reset.

The MACHINE HOURS counter cannot be reset.

DOWNLOADING COMPLIANCE DATA

COMPLIANCE ISSUES

The VPAP II ST-A measures the total hours the patient has been using the device, so that usage can be determined and monitored. This may be of particular importance in patients who fail to respond appropriately to therapy.

Patient Hours can be viewed when in Patient mode. To view Patient Hours see "Patient Hours" on page 71. Patient Hours are reset/cleared using the COMPLIANCE RESET item in the Clinical Mode menu. The recording of patient hours will not commence unless the motor is on, the mask is on and the ramp period, if activated, has completed.

More comprehensive compliance data and reports can be obtained by downloading information from the VPAP II ST-A to a computer either directly or via modem, using the AUTOSCAN compliance software.

The VPAP II ST-A records compliance data every 6 minutes, and will store up to 200 days of compliance data. To download this data, you will need a Clinical Interface Kit. For more details, please contact your supplier or refer to the *AutoScan Clinician's Manual* (version 3.0 or later).

DELAY TIMER

If the patient experiences difficulty falling asleep with full pressure, they may wish to use the Delay Timer. The airflow starts very gently while they fall asleep, and slowly increases to full operating pressure over a selected time period. The timer can be set to 5, 10 or 20 minute delay periods. The clinical mode **must be locked** to use the Delay Timer.

It is important to note that the Delay Timer may not be suitable for some patients. This is due to fact that when the Delay Timer is chosen, the pressure starts in CPAP and gradually ramps up to deliver the prescribed pressure support. This means that

the patient is not receiving the full pressure support level during the ramping period (see Figure 16).

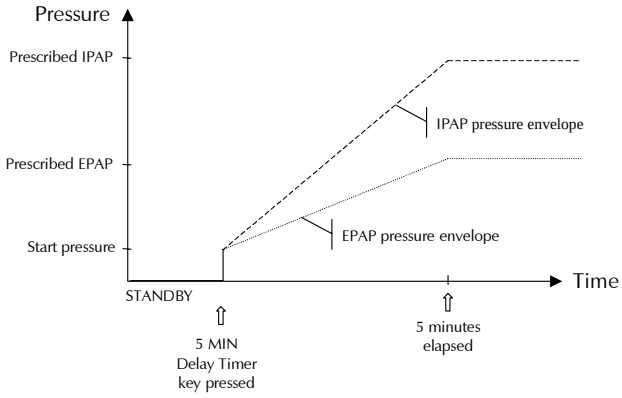


Figure 16: Pressure increase with Delay Timer

To start the Delay Timer, choose a delay time and press the corresponding button (must be in Patient Mode). The air will start to flow automatically. There is no need to push the **Start/Stop** button. If the patient has not yet fallen asleep when the flow reaches full pressure, they may press one of the **Delay Timer** buttons again.

You may disable the Delay Timer entirely by removing all the delay options–until only 0 is remaining. The VPAP II ST-A Delay Time default is zero. See "VPAP II ST-A Set-up" on page 18. Alternatively, you can limit the delay periods available to the patient. For example, you may choose to remove the 20 minute delay option. Should the patient then press the 20 minute Delay Timer button, the VPAP II ST-A will start with the next available delay, ie. the 10 minute delay.

USING BATTERY POWER

FREQUENTLY ASKED QUESTIONS

CAN I RUN A VPAP II ST-A DEVICE FROM A BATTERY? HOW?

Yes, ResMed VPAP II ST-A devices can be run from a battery, for example a 12V or 24V battery. To do this you will need a deep-cycle battery and an inverter. Note that typical automotive batteries may only be safely discharged to 80% of their full charge and are therefore not suitable for use with the VPAP II ST-A.

For further information about choosing a battery, consult your inverter and/or battery supplier.

WHAT CAPACITY BATTERY WILL I NEED TO BUY TO RUN A VPAP II ST-A DEVICE?

The capacity of the battery is given in amp-hours. You will need to determine the correct capacity, which depends on the prescribed pressure setting and the number of hours the VPAP II ST-A will be running on battery power. Purchase a battery that will amply supply your needs. Use the table "Calculating battery capacity required" on page 85 as a guide.

WHAT TYPE OF INVERTER IS SUITABLE FOR USE WITH A VPAP II ST-A DEVICE?

Any CE (for EU countries) or UL (for the USA) marked inverter, with both a minimum continuous output power rating of 150W and a surge rating (<50 milliseconds) of 500W when the VPAP II ST-A is switched on, will be suitable. If the inverter manufacturer lists only a peak power rating, contact the manufacturer to obtain the surge power rating.

NOTE

It is also recommended that the inverter is certified by an accredited testing and certification organization, such as VDE, TÜV or BSI in addition to CE markings (for EU countries). Please contact your local ResMed office for further information.

CAN I USE A HUMIDIFIER WITH AN INVERTER?

No. Humidifiers are not suitable for use with inverters.

WARNING

The use of an inverter with a humidifier may result in serious damage to the humidifier and serious injury to the user.

How do I set up my battery and inverter to power a VPAP II ST-A device?

Connect your inverter to your battery, then connect your VPAP II ST-A to the inverter. Refer to the inverter manufacturer's instructions when connecting the inverter to the battery. Be careful to observe the correct polarity (match positive (+) and negative (-) cable to battery posts).

Alternately, connect your deep-cycle battery to the inverter via the cigarette lighter socket.

For advice on how to maintain your deep-cycle battery in good condition, consult your battery supplier.

Power consumption with the VPAP II ST-A series

Use the table to estimate the power consumption for typical running conditions of your VPAP II ST-A device. This will determine the capacity of the battery you require.

1. Select an EPAP pressure. (Select the closest pressure in the table.)
2. Select an IPAP pressure. (Select the closest pressure in the table; 25 cm H_2O will give the worst-case power consumption.)

3. The charge consumed by the VPAP II ST-A = the DC current x hours used. In the table, total charge is quoted for eight hours of use. The values in the table are based on a respiratory rate of 15 BPM.

CALCULATING BATTERY CAPACITY REQUIRED

EPAP (cm H_2O)	IPAP (cm H_2O)	Charge for 1 hour (amp-hours)	Total charge required for 8 hours (amp-hours)	Minimum recommended battery capacity* (amp-hour rating)
4	8	1.51	12.1	29
4	16	1.86	14.9	36
8	16	2.03	16.3	40
12	16	2.09	16.7	42
4	25	2.22	18.5	45
8	25	2.37	19.0	46
12	25	2.40	19.2	47

* Amp-hour rating for 8 hours of use

Sample calculation

If EPAP pressure = 12 cm H_2O, IPAP pressure = 25 cm H_2O and respiratory rate = 15 BPM, then the energy used in 8 hours = 19.2 amp-hours.

Minimum recommended battery capacity (amp-hour rating) = 47.

NOTE

The values above are based on a respiratory rate of 15 BPM. Power consumption (and recommended battery size) will increase with faster respiratory rates.

CO_2 REBREATHING DATA

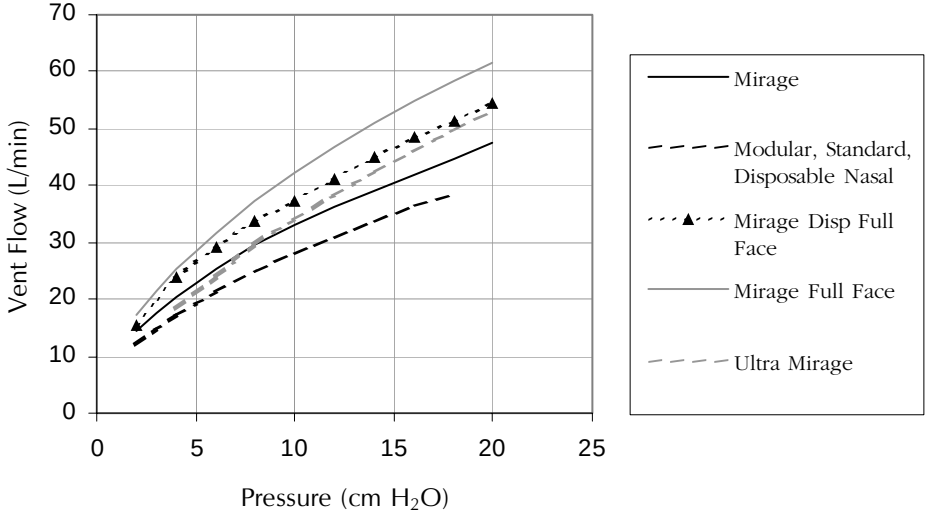
IMPORTANT INFORMATION ON CO_2 REBREATHING

The VPAP II ST-A is intended to be used with special masks or connectors which have vent holes to allow a continuous flow of air out of the mask. When the VPAP II ST-A is turned on and functioning properly, new air from the device flushes exhaled air out through the mask vents. However, when the machine is not operating, fresh air will not be provided through the mask and exhaled air may be rebreathed. Rebreathing of exhaled air for longer than several minutes can in some circumstances lead to suffocation. This warning applies to all bi-level pressure devices.

The amount of rebreathing is dependent upon respiratory rate, tidal volume, I:E ratio, leak characteristics of the patient interface (eg. dead-space) and EPAP pressure. To a lesser extent, IPAP pressure will also affect rebreathing. Lower pressures, higher tidal volumes, and higher percentage IPAP will increase the amount of retained CO_2 and thus increase rebreathing.

The pressure/flow characteristics graph below provides the exhaust/flow characteristics of the ResMed masks available for use with VPAP II ST-A devices.

MASK FLOW/PRESSURE CHARACTERISTICS



The CO_2 rebreathing table below provides information on CO_2 rebreathing at different EPAP levels and tidal volumes. This information may assist in assessing the CO_2 rebreathed at particular device settings.

The characteristics of masks other than those listed in the following table may be different, and it is important to select a mask that provides comfort while delivering correct treatment.

NOTE

The data provided is derived from bench testing and is for guidance only. The amount of CO_2 rebreathing in actual clinical use may vary. It is recommended that patient monitoring be performed to assess the adequacy of patient CO_2 level management, particularly at low EPAP pressures.

TABLE 2: CO_2 REBREATHING

- Breath rate = 15 BPM
- Tested under conditions of no leak.

	Volume of CO_2 rebreathed per breath (ml) See note 1															
	Tidal vol.= 200 mL End tidal CO_2 =40 mmHg				Tidal vol.= 300 mL End tidal CO_2 =40 mmHg				Tidal vol.= 500 mL End tidal CO_2 =40 mmHg				Tidal vol.= 600 mL End tidal CO_2 =40 mmHg			
EPAP (cm H_2O)	Mirage	Modular	Ultra Mirage	Mirage Full	Mirage	Modular	Ultra Mirage	Mirage Full	Mirage	Modular	Ultra Mirage	Mirage Full	Mirage	Modular	Ultra Mirage	Mirage Full
0 (see note 2)	5.5	4.8	2.5	2.3	10.3	10.2	12.7	4.7	21.4	20.4	25.2	8.6	26.0	25.1	30.9	10.7
2	1.6	1.0	2.4	0.6	2.0	2.1	4.3	0.9	3.0	3.3	6.4	1.1	4.2	3.5	7.5	2.5
3	1.4	1.0	2.2	0.6	1.7	1.8	3.9	0.7	2.7	3.0	5.5	0.9	3.1	2.9	5.7	1.6
4	1.3	0.9	2.1	0.6	1.5	1.6	3.5	0.7	2.2	2.6	4.8	0.8	2.6	2.4	4.8	1.1
8	1.2	0.8	1.6	0.6	1.3	1.4	2.6	0.6	1.6	2.1	3.5	0.7	1.8	2.0	3.4	0.8
12	1.1	0.8	1.4	0.5	1.2	1.3	2.1	0.6	1.5	1.7	2.8	0.6	1.6	1.6	2.8	0.7
20	1.0	0.6	1.2	0.5	1.2	1.2	1.6	0.4	1.3	1.5	2.1	0.6	1.5	1.6	2.2	0.6

1 The flow rate of CO_2 into the breathing simulator was adjusted to give a base line end tidal (ie. no rebreathing back into the simulator) CO_2 = 39 mmHg. As the tidal volume increased, the base line end tidal CO_2 decreased proportionally.

2 The minimum working pressure of the VPAP II ST-A is 2 cm H_2O. These measurements were taken with the air tube detached from the mask.

TECHNICAL INFORMATION

PRESSURE CALIBRATION

VPAP II ST-A does not require regular calibration. However, if you feel that it is necessary the following pressure calibration procedure can be conducted without returning the unit to an authorized service agent.

To calibrate the VPAP II ST-A you will need:

- The patient's device, mask system and air tubing, and any accessories if used, eg. humidifier, filters etc
- A reference manometer with a range of 0–30 cm H_2O in intervals of 0.1 cm H_2O, or a RESCONTROL, fitted with a sensor tube (3 or 2.5mm internal diameter) and a standard Luer taper fitting
- If available, a ResMed Modular mask and blind BUBBLE CUSHION®.

NOTE

For complete instructions on using the ResControl to calibrate the VPAP II ST-A, refer to the ResControl Clinician's Manual.

PROCEDURE

1. Assemble the VPAP II ST-A as the patient would normally use it, and connect all accessories (eg. humidifier, filters, O_2 etc) that are normally used. If you have a Modular mask, connect this instead of the patient's normal mask, and fit the blind Bubble Cushion.

   If you do not have a Modular mask or a blind BUBBLE CUSHION, you can use the patient's normal mask and block the opening with the palm of your hand. If you are using a MIRAGE mask, be careful not to block the mask exhaust vents.

2. Turn the VPAP II ST-A on to allow the pressure transducer to warm up. The motor does not need to be running; if it does start running, press the **Start/Stop** button to stop the flow. Let the device warm up for 15 minutes.
3. Remove the plug from one of the access ports on the mask, and insert the Luer taper end of the sensor tube. The other end of the sensor tube should be fitted to the manometer or the RESCONTROL.
4. Access the setting menus (Clinical Mode), and select the CALIBRATE from the secondary menu. You may need to turn the VPAP II ST-A off and then on again with the buttons held down (see "VPAP II ST-A Set-up" on page 18). The flow will start automatically.

5. Read the pressure on the manometer or RESCONTROL and adjust the gain value using the ▲ **OPTION** ▼ buttons on the VPAP II ST-A until the pressure reading is 16 ± 0.2 cm H_2O.
6. To store the new calibration setting, press the **Start/Stop** button, or change the menu with the ▲ **MENU** ▼ buttons.

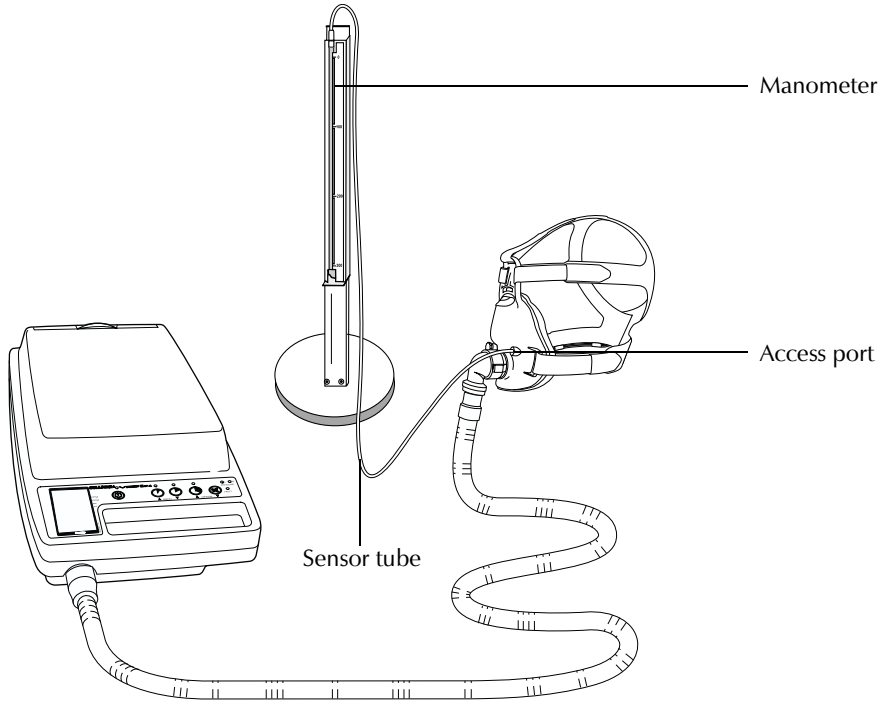


Figure 17: Connecting the VPAP II ST-A to a manometer for calibration

CLEANING & MAINTENANCE

DAILY

Test the mask alarm every day before use and each time any component of the breathing circuit is altered. See "Mask Alarm Test (daily)" on page 77.

Disconnect the air tubing and mask.

Wipe the inside and outside of the mask and cushion with a clean damp cloth.

Hang up to dry in the shade.

WEEKLY

Test the buzzer/LED and power failure alarm every week as described in "Buzzer/LED Test (weekly)" on page 77 and "Power Failure Alarm Test (weekly)" on page 77.

Wash the mask and air tubing with pure soap. Do not use moisturizing, deodorizing, fragranced or antibacterial soaps. Refer to the mask user guide for further information.

Wash the headgear and straps with pure soap and drip dry.

Check the mask outlets for blockages.

MONTHLY

Test the low pressure alarms once a month as described in "Low Pressure Alarm Test (monthly)" on page 77.

PERIODICALLY

The exterior of the VPAP II ST-A should be cleaned with a damp cloth and mild detergent.

The mask and air tube are subject to normal wear and tear. Inspect them regularly for any damage.

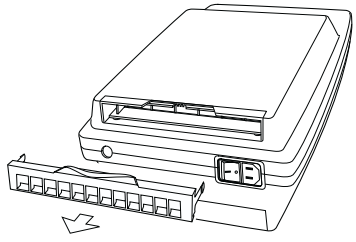
WARNINGS

- Always unplug the VPAP II ST-A before cleaning, and be sure that it is dry before plugging it back in.
- The air tubing and some mask systems are single-patient use only to avoid the risk of cross-infection between patients. Refer to the user instructions supplied with your mask system for further information.

CAUTIONS

- Do not use bleach, chlorine, alcohol, or aromatic-based solutions, scented oils, moisturizing, deodorizing, fragranced or antibacterial soaps to clean the VPAP II ST-A or the mask system as these may damage or otherwise reduce the life of the product.
- For full details on cleaning or sterilizing your mask, refer to your mask User's Guide.

REPLACING THE AIR FILTER STRIP



The air filter strip should be replaced approximately every 1500 operating hours (ie. 6 months with 8 hours a day usage) or when visibly dirty.

To remove the air filter, slide out the air filter cover.

Instructions on replacing the air filter strip are supplied with new filters.

CAUTION

The air filter strips are not washable or reusable.

OVERHEATING

In rare circumstances when high ambient room temperature is combined with rapid breathing and large pressure changes, the air pump may overheat. A clogged air inlet filter may also contribute to this occurrence. The VPAP II ST-A alarm will activate and display "O'HEAT ALARM" in the message panel of the LCD screen.

Pressing the **Alarm Cancel** button will silence the audible alarm and erase the message on the LCD, but the indicator light will remain lit until you correct the cause of the alarm. The audible alarm will not retrigger while the original alarm condition persists. When the alarm condition is resolved, the visual and audible alarms are reset.

In the event of an overheat condition, the VPAP II ST-A will automatically revert from bi-level treatment to a constant pressure for about 15 minutes to allow the pump to cool. When cool, the pump will automatically return to normal operation. If constant pressure treatment is inappropriate for the patient, you can also press the **Start/Stop** button, allow the VPAP II ST-A to cool, then resume normal treatment.

NOTE

The factory default setting is for the EPAP (exhalation pressure) to be delivered in the event of an overheat condition. This setting can be changed to the higher IPAP (inhalation pressure) if appropriate using the OVERHEAT DEFAULT menu. See "VPAP II ST-A Set-up" on page 18.

WARNING

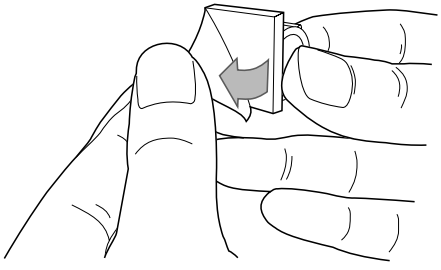
If using the ResAlarm II in conjunction with the VPAP II ST-A note that the ResAlarm II is configured to alarm if the pressure falls above or below IPAP. However, if the pressure stays at IPAP, the alarm will not activate. Therefore the factory overheat default setting should not be changed to IPAP under any circumstance.

USING THE POWER CORD CLIP (OPTIONAL ACCESSORY)

The power cord clip can be used to minimize the chance of the power cord becoming dislodged from the power inlet. The power cord clip is available through your ResMed supplier.

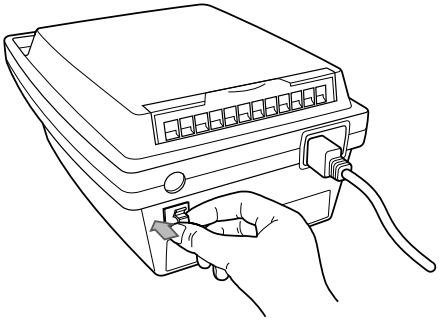
1

Make sure the surface is clean and dry. Peel the paper backing off the cable clip.



2

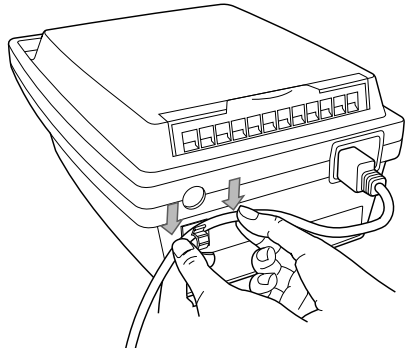
Press the cable clip firmly against the flat surface on the back of the device.



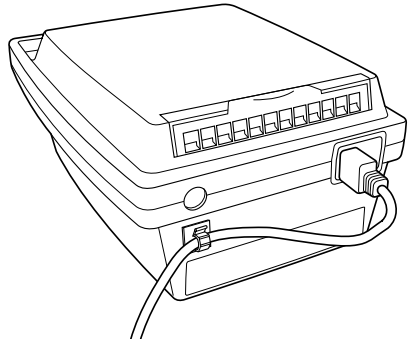
3

Wait 2 minutes after placing the cable clip.

4 Push the power cord firmly into the cable clip to secure it.



5 The power cord should now be fixed securely to the VPAP II ST-A.



SERVICING

The VPAP II ST-A is designed to give years of trouble-free operation. It will not require regular servicing provided that it is cleaned and maintained according to instructions. If you feel that the unit is not performing properly, check the troubleshooting table on page 95.

If it is still not working properly, contact ResMed or an authorized service agent.

CAUTION

Inspection and repair should only be performed by an authorized service agent. Under no circumstances should you attempt to service or repair the unit yourself.

TROUBLESHOOTING

Problem	Possible cause	Solution
VPAP II ST-A does not start when you press the **Start/Stop** *or* **Delay Timer** *button (and the LCD screen is blank)*	• Power cord is not connected properly	• Check both ends of the power cord
	• VPAP II ST-A is not switched on	• Switch on main switch at rear of unit
	• Power outlet may be faulty	• Try another power outlet
SmartStart is enabled but flow does not start when you begin breathing in the mask	• Breath is not deep enough to trigger SmartStart	• Take a deep breath in and out through the mask
	• Excessive leak	• Adjust position of mask and headgear • Replace any plugs that may be missing from ports on mask • Ensure air tube is connected firmly at both ends • Straighten kinked air tube or replace punctured air tube
	• SmartStart not enabled (does not appear on the LCD screen)	• Enable the SmartStart option or use **Start/Stop** button to start the device
	• Mask or mask/valve combination affecting SmartStart	• Use the **Start/Stop** button to start the device
SmartStart is enabled, but the VPAP II ST-A does not stop automatically when you remove your mask	• SmartStart not enabled (does not appear on the LCD screen)	• Enable the SmartStart option or use the **Start/Stop** button to start the device
	• Mask Alarm enabled (**M** appears on the LCD screen)	• Use the **Start/Stop** button to stop the device; the Mask Alarm overrides SmartStart

(continued over page)

Problem	Possible cause	Solution
(continued from previous page)	• Humidifier or bacterial filter used but Humidifier option has not been selected (does not appear on the LCD screen)	• Enable Humidifier option • Use a lower impedance bacterial filter
	• Incompatible humidifier or mask system being used	• Use only equipment as recommended and supplied by ResMed
	• Device incorrectly calibrated	• Return to supplier for calibration
Mask Alarm is enabled, but alarm does not activate when the mask is removed during treatment	• Incompatible air delivery system being used	• Use only equipment as recommended and supplied by ResMed • Enable the Humidifier option (see "Using SmartStart or the Mask Alarm with a humidifier or antibacterial filter" on page 64)
	• Humidifier or bacterial filter used but Humidifier option has not been selected (does not appear on the LCD screen)	• Enable the Humidifier option • Use a lower impedance bacterial filter
	• IPAP and/or EPAP settings are too low for the air delivery components being used	• Enable the Humidifier option • Increase IPAP and/or EPAP pressure if appropriate • Use different air delivery components

(continued over page)

Problem	Possible cause	Solution
(continued from previous page) *VPAP II ST-A mode set to S, S/T or T and delivers a single pressure instead of alternating between the two set pressures (and pressure indicator displays a constant level)*	• Rapid breathing and a room temperature above 35°C (95°F) have caused the motor to overheat (**O'HEAT** appears on LCD screen and the alarm is activated)	Cancel the alarm by pressing the **Alarm Cancel** button and/or: • if the patient is comfortable with the constant pressure, let it run. The motor will cool down after about 15 minutes and resume normal operation • if the single pressure is uncomfortable, stop the unit by pressing the **Start/Stop** button and allow it to cool. You may resume normal operation when cool • cool the room if possible, but do not direct the source of cold air toward the device
	• Blocked air filter has caused overheating	• Remove blockage or replace clogged filter
	• Blocked air inlet	• Remove blockage
Insufficient air flow delivered from the VPAP II ST-A	• Delay Timer is in use	• Wait for air pressure to build up gradually, or press the **Start/Stop** button to start immediately
	• Air filter strips are dirty	• Replace air filter strips
	• Air tubing is kinked or punctured	• Straighten or replace air tubing
	• Air tubing is not connected properly	• Check and tighten both ends of the air tubing
	• Plugs missing from the mask ports	• Replace plugs

(continued over page)

Problem	Possible cause	Solution
Air leaking around nose and eyes	• Nasal cushion not fitted properly onto mask frame	• Fit cushion properly
	• Mask and headgear straps not positioned correctly	• Adjust position of mask and headgear (Note: tighter is not always better)
	• Plugs missing from mask ports	• Replace plugs
	• Nasal cushion is torn or distorted	• Replace cushion
Alarms not working when tested (for problems with the Mask Alarm, see the Mask Alarm reference on the previous page)	• Malfunction	• Return to supplier for service

SPECIFICATIONS

RESMED VPAP II ST-A

DEVICE

DIMENSIONS (HxWxL): 142 x 240 x 350mm (5.6 x 9.5 x 13.8in)

Weight: 3.5kg (7.7lb)

Power Supply: Mains: Input range 110–240V, 50–60Hz, 200VA, voltage is self selecting

External battery: Via certified and CE (EU countries) or UL (for USA) marked inverter with:

- minimum continuous output power rating of 150W.
- surge rating of 500W (<50 milliseconds)

Storage Temperature: -20 to 60ºC (-4 to 140ºF)

Operating Temperature: 5 to 40ºC (41 to 104°F)

Operating Humidity: 15 to 95% RH

IEC 60601-1 CLASSIFICATION

Class II

Type CF

GLOSSARY OF SYMBOLS

Read Operating Manual before use/Lire le manuel d'utilisation avant emploi

Class II (double insulated)/Classe II (double isolation)

Type CF Applied Part/ Partie appliquée du type CF

CYCLING

Breaths Per Minute (BPM): 5 to 30

Breathing Rate Accuracy: 1%

Inspiratory to Expiratory Ratio (I:E): 1:9 to 1:0.1 (10 to 90% of breath period)

Dynamic pressure and flow characteristics

Pressure/Flow range:

IPAP: 2 to 25 cm H_2O

EPAP: 2 to 25 cm H_2O

Pressure Calibration Accuracy: ± 1 cm H_2O of the indicated control setting

Compliance data

History: 200 Days, day by day measured at pressure

Resolution: ± 6 mins/day

Internal Clock accuracy: ± 30 seconds per month

Internal Clock Battery life: 5 years

Compliance data is viewed using the ResMed windows application SCAN or AutoScan (v3.0 or greater). Data is down loaded via modem or direct cable connect

Mask Alarm

See “Mask Alarm” on page 75.

Display

Estimated Leak Range: 0 to 150 L/min

Estimated Tidal Volume Range: 0 to 3000 mL

Note

Leak and Tidal Volume displays are estimates. They are provided for trending purposes only.

Measured Respiratory Rate Range: 0–60 BPM ± 10%

Measured Delivered Pressure Range: 0 to 35 cm H_2O ± 1 cm H_2O

Air outlet

To fit standard 22mm tapered connection

Pressure measurement

Internally mounted pressure transducer

Flow measurement

Internally mounted flow transducer

Note

The manufacturer reserves the right to change these specifications without notice.

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